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REPORT NO. 223

PRESSURE DISTRIBUTION ON THE C-7 AIRSHIP

By J. W. CROWLEY, Jr., and S. J. DeFRANCE

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AERONAUTICAL SYMBOLS

1. FUNDAMENTAL AND DERIVED UNITS

	Symbol	Metric		English	
		Unit	Symbol	Unit	Symbol
Length	l	meter	m.	foot (or mile)	ft. (or mi.).
Time	t	second	sec.	second (or hour)	sec. (or hr.).
Force	F	weight of one kilogram	kg.	weight of one pound	lb.
Power	P	kg.m/sec		horsepower	H. P.
Speed		m/sec	m. p. s.	mi/hr	M. P. H.

2. GENERAL SYMBOLS, ETC.

Weight, $W=mg$.

Standard acceleration of gravity, $g=9.806\text{m/sec.}^2=32.172\text{ft/sec.}^2$

Mass, $m=\frac{W}{g}$

Density (mass per unit volume), ρ.

Standard density of dry air, 0.1247 (kg.-m.-sec.) at 15.6°C. and 760 mm. = 0.00237 (lb.-ft.-sec.).

Specific weight of "standard" air, 1.223 kg/m.^{3} = 0.07635 lb/ft.^{3}

Moment of inertia, mk^2 (indicate axis of the radius of gyration, k, by proper subscript).

Area, S; wing area, S_w, etc.

Gap, G

Span, b; chord length, c.

Aspect ratio $=b/c$

Distance from $c.\ g.$ to elevator hinge, f.

Coefficient of viscosity, μ.

3. AERODYNAMICAL SYMBOLS

True airspeed, V

Dynamic (or impact) pressure, $q=\frac{1}{2}\rho V$

Lift, L; absolute coefficient $C_L=\frac{L}{qS}$

Drag, D; absolute coefficient $C_D=\frac{D}{qS}$

Cross-wind force, C; absolute coefficient $C_C=\frac{C}{qS}$.

Resultant force, R

(Note that these coefficients are twice as large as the old coefficients L_c, D_c.)

Angle of setting of wings (relative to thrust line), i_w

Angle of stabilizer setting with reference to thrust line, i_t.

Dihedral angle, γ.

Reynolds Number $=\rho\frac{Vl}{\mu}$, where l is a linear dimension.

e. g., for a model airfoil 3 in. chord, 100 mi/hr., normal pressure, 0°C: 255,000 and at 15.6°C, 230,000;

or for a model of 10 cm. chord, 40 m/sec., corresponding numbers are 299,000 and 270,000.

Center of pressure coefficient (ratio of distance of $C.\ P.$ from leading edge to chord length), C_p.

Angle of stabilizer setting with reference to lower wing $(i_t-i_w)=\beta$

Angle of attack, α

Angle of downwash, ϵ

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SUMMARY

This investigation was made by the National Advisory Committee for Aeronautics at the request of the Bureau of Aeronautics, Navy Department, for the purpose of determining the aerodynamic pressure distribution encountered on a "C" class airship in flight. It was conducted in two parts (*a*) tests on the tail surfaces in which the pressures at 201 points were measured and (*b*) tests on the envelope in which 190 points were used, both tests being made under as nearly identical flight conditions as possible, so that the results could be combined and the pressure distribution over the entire airship obtained.

The method of testing consisted of measuring the pressures by means of orifices located at the desired points connected to the tubes of a multiple liquid manometer. Simultaneous readings of all the pressures were obtained by photographing the manometer.

The results as presented in this report are mainly in tabular form and may be very briefly summarized as follows:

(1) The maximum local pressure encountered on a tail surface was 7.3 lb./sq. ft.

(2) The maximum total normal force on a complete tail surface was 352 pounds or a C_{NF} of 0.316 occurring on the bottom fin and rudder during a "reversal" of the rudder.

(3) The maximum moment of the tail surface forces about the center of buoyancy was 37,200 lb. ft.

(4) The investigation of the envelope pressures, while showing the general distribution of pressure satisfactorily, is practically useless in the determination of total aerodynamic forces on the airship.

(5) It is concluded that the pressures set up by a bump are larger than those obtained in maneuvering.

INTRODUCTION

The available data concerning the aerodynamic forces experienced by an airship in flight are very scarce. The British have made some pressure distribution measurements on the tail surfaces of the rigid airships, R-26 and R-32, but only comparatively few points were investigated, and the results, consequently, are not at all complete. So far as is known, there has been no previous complete investigation of pressures on an airship envelope in flight. About the time that these tests were being carried out, an investigation was being made on the hull of the ZR-3 at Friedrichshafen, but the results have not been published.

In these experiments, covering both the envelope and tail surfaces, pressures were recorded at both high and low speeds for each control setting. The maneuvers were: Steady turns, steady climbs and descents, starting of turns and climbs, reversals from left turn to right turn, rising light, flying horizontally while light, and flying through gusts. The airship was flown under all of these conditions in order to make sure that the maximum pressures encountered in normal flight were obtained or exceeded.

METHODS AND APPARATUS

Apparatus.—Pressure pads of the type developed and calibrated in the United States Navy Aerodynamical Laboratory (Reference 1, fig. 1) were cemented directly opposite each

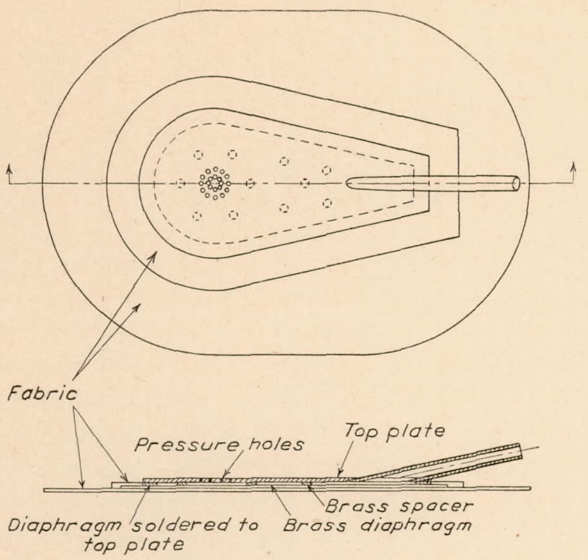

FIG. 1.—Static pressure pad

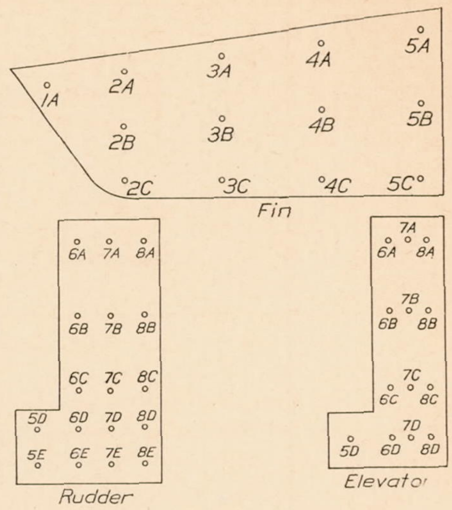

FIG. 2.—Location of pressure pads on tail surfaces

other on the two sides of the tail surfaces at the points indicated in Figure 2 and on the envelope as shown in Figure 4. In securing the pressure pads to the airship, the connecting tube (fig. 1) was placed to the rear so as to eliminate the influence of the tube on the air flow about the orifice. The orifices were connected by rubber and aluminum tubing to a multiple liquid manometer located in the control car. Each aluminum tube on the tail surfaces was laid next to the fabric (fig. 3), so as to avoid bunching of tubes, which would have caused a great disturbance in the flow.

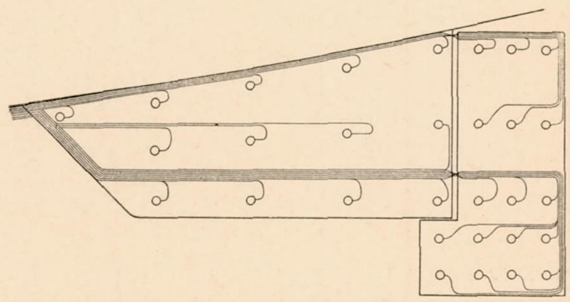

FIG. 3.—Arrangement of tubing on tail surfaces

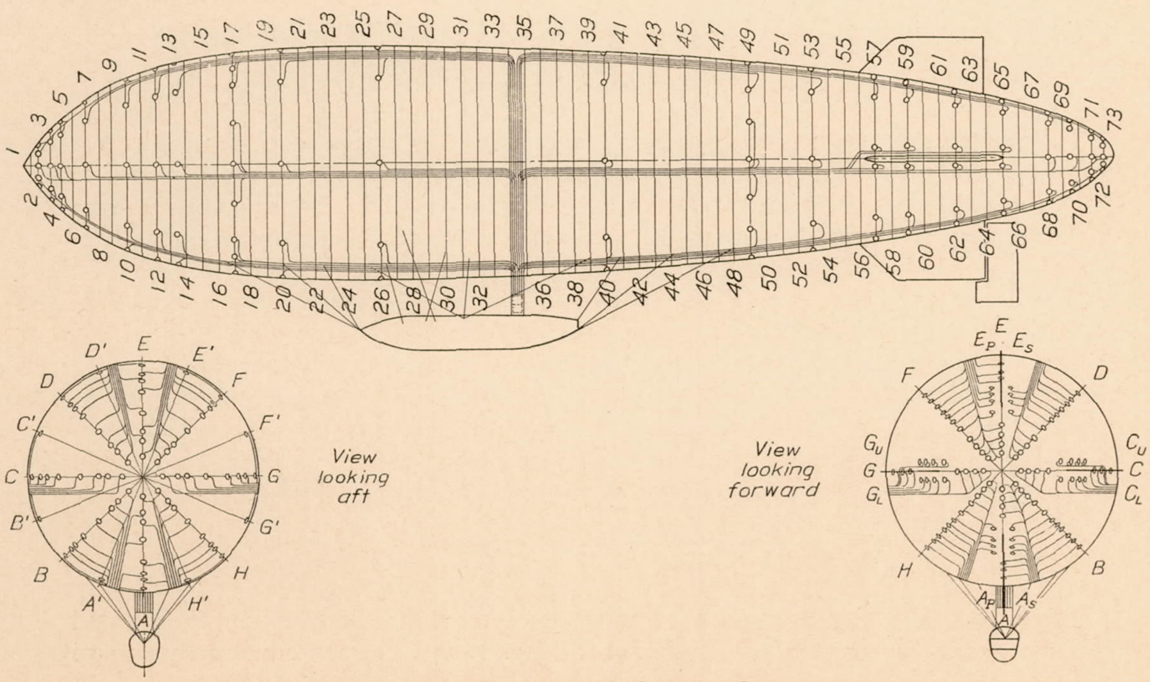

FIG. 4.—Location of pads and tubing on envelope

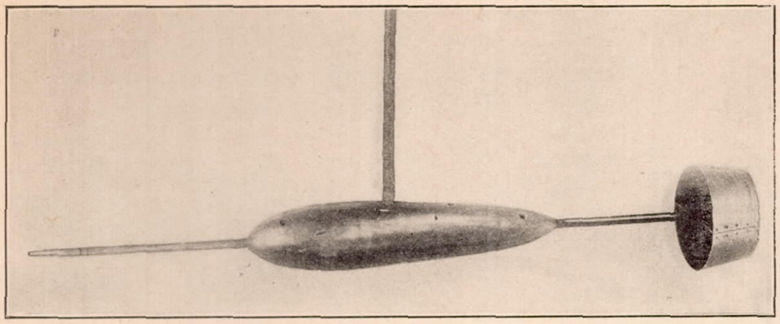

FIG. 5.—Pitot-static head

The multiple liquid manometer (fig. 7) consisted of 224 glass tubes arranged in four groups. Each group consisted of two reservoirs connected by a brass header, out of which projected 56 glass tubes, each of which, save 4, was connected to one of the pressure orifices. Three of the other 4 were connected to an air reservoir in the cockpit and the fourth to the trailing static head (fig. 5). The line connecting the level of liquid in the three tubes provided a datum line, in accordance with the roll of the airship, from which pressures could be measured, while that in the fourth tube gave the true static pressure outside of the flow caused by the airship.

The four manometer units were mounted together in one box, and to obtain records (fig. 6) the complete assembly was photographed by a specially designed camera (fig. 7). The camera consisted of a light-tight box and a film container which was removable in daylight. The capacity of the container was a roll of film sufficient for 27 exposures, 6 inches by 6 inches. The spool on which the exposed film was wound was turned by a handle, which in turn, by means of a tripping device, operated the shutter once every revolution, thereby making the record. At each operation of the shutter an electrical contact was made which caused a light to flash and make a timing line on all records being made on drum type instruments. In this investigation an N. A. C. A. recording air-speed meter (Reference 2) and a recording statoscope and inclinometer were used, and by means of the timing lines all records were synchronized.

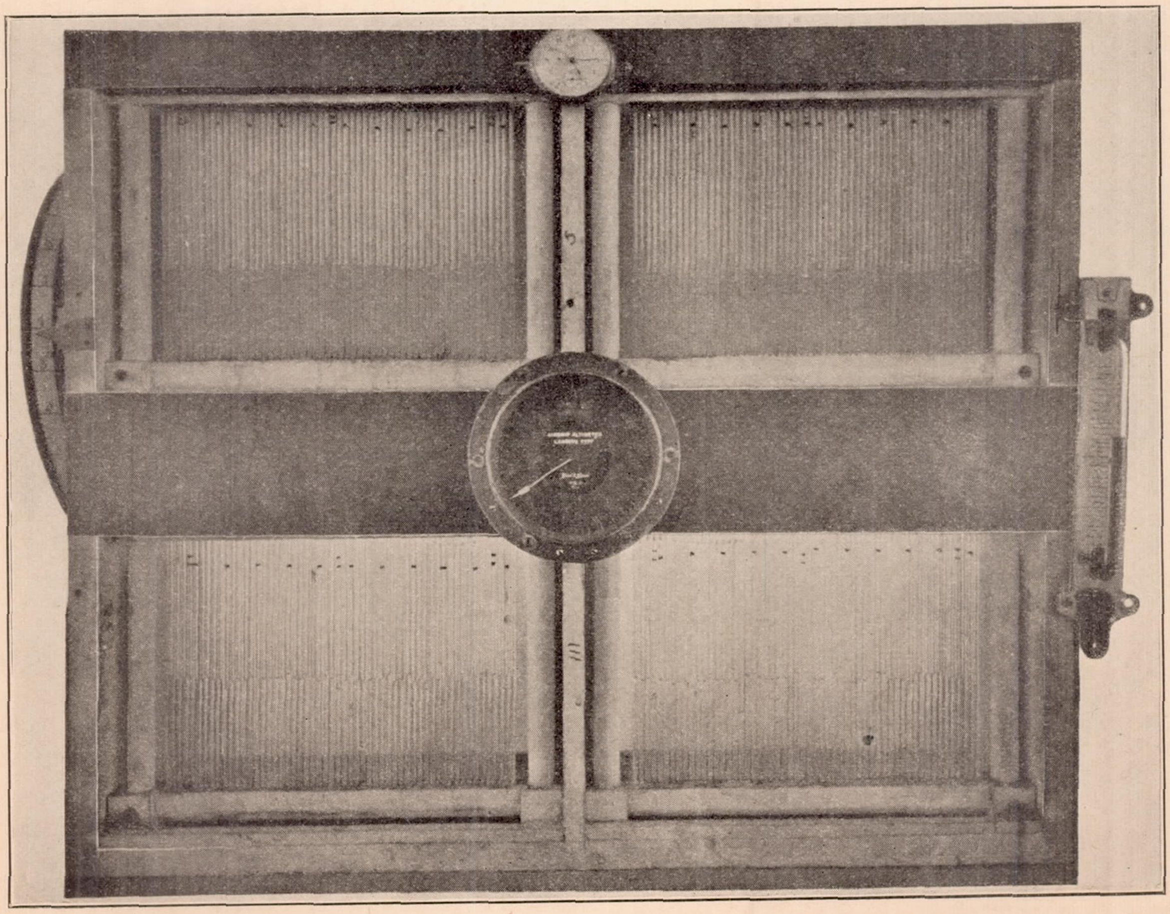

FIG 6.—Manometer record

Other instruments used in these tests were: rudder position indicator, low range precision altimeter, yaw indicator, stop watch, and thermometer. The rudder position indicator, altimeter, and stop watch were mounted on the manometer box and were photographed with the pressure tubes. The recording air-speed meter and the recording statoscope were connected, respectively, to a trailing Pitot-static head and a trailing static head (fig. 5). Both of these heads were suspended 25 feet below the car so as to be outside of the disturbed flow caused by the airship. The recording statoscope consisted of a recording air pressure capsule, a vacuum bottle, and a by-pass valve connected as shown in Figure 8. The yaw indicator consisted of a protractor mounted on the side of the car. By sighting on the trailing Pitot-static head, the angle of yaw at the car was read on the scale. The rudder position indicator consisted of a graduated disk, which was connected to the rudder control cables. The thermometer was attached to the outside of the car so as to obtain the air temperature for computing the air density.

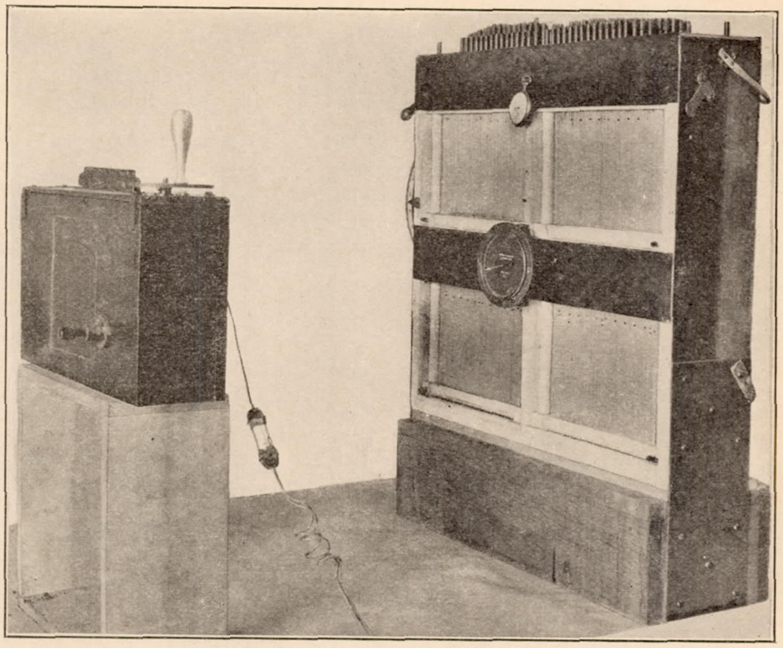

FIG. 7.—Manometer and camera as set up on the ship

The position of the control surfaces was indicated to the pilot by two telautograph instruments, which measure the angles between the stabilizers and movable surfaces and then electrically communicate the readings to an indicator in the cockpit.

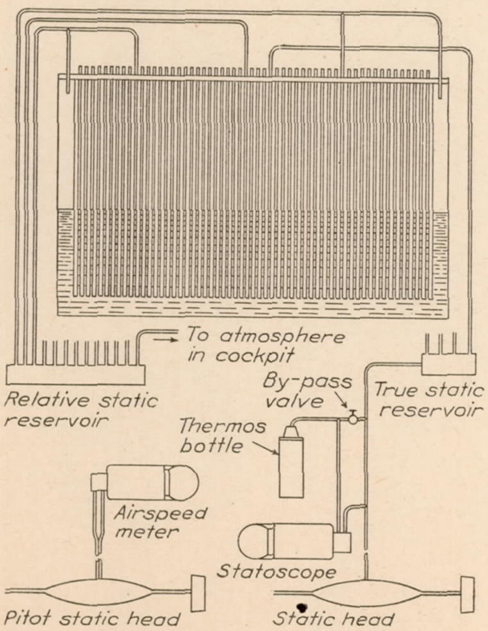

FIG. 8.—Diagram of manometer and instrument connections

Method of tests.—Before the flight tests were made all the connecting tubes were tested for leaks and stoppages. This was accomplished by blowing through the tubes from the orifice end of the line. A manometer at this end and the reading indicated on the multiple manometer were observed at the same time and compared. The same procedure was carried out at the completion of the set of tests and any lines which indicated leaks were discarded. The helm angle indicator was calibrated and the zero reading of the yaw protractor noted for an angle of zero yaw relative to the longitudinal axis of the car.

Before each flight the pilot was supplied with a list of the conditions desired and the camera and recording instruments were loaded. Two observers were required and their first operation was to lower the two trailing bombs. Both observers then gave their attention to the pilot and awaited his signal that the desired condition had been reached. For steady flight conditions simultaneous records of all the instruments were made on receipt of this signal. In changing flight conditions two records were obtained, the first immediately after the movement of the controls and the second as soon after that as possible. With the camera used

the interval between pictures was three seconds. In the reversal condition four photographs were obtained in the above manner. The readings of the helm angle and revolutions per minute were recorded by the pilot.

The maneuvers in which pressures were recorded are tabulated in Table I, which is self-explanatory with the exception of the "light" conditions (runs 22 to 25, inclusive). To obtain these flights while statically light, the airship was brought to equilibrium at a definite altitude and 500 pounds of ballast released. In this condition a horizontal flight was made, maintaining a constant altitude by aid of the elevators (runs 22 and 23) and also a flight with the airship on an even keel but rising due to excess lift (runs 24 and 25).

Reduction and presentation of data.—The data were all obtained from photographic records, except the angle of yaw, temperature, and revolutions per minute, which were tabulated from indicated readings. To facilitate reading of the manometer records, the negatives were placed in a projection lantern and the enlarged image thrown on a screen. The magnification was so chosen that the head of alcohol could be scaled off directly in pounds per square foot. A wire over the screen was shifted so as to run through the images of the menisci of the three tubes, which were connected to the air reservoir in the cockpit. This gave the angle of roll of the ship and a base line to work from. A second wire was shifted into parallelism with the first and passed through the image of the meniscus in the tube connected to the trailing static head. The height of liquid in the various tubes above the latter wire gave directly the pressures relative to the true static condition outside of the disturbed flow.

The rate of change of static pressure, as recorded by the statoscope, was converted into rate of change of altitude by the use of the atmospheric tables. This rate of change of altitude divided by the air speed along the line of flight, gave the sine of the angle of inclination of the flight path. By subtracting this angle of inclination from the angle of inclination of the car as recorded by the inclinometer, the angle of pitch was obtained.

The maneuvers in which the pressures were investigated are given in Table I, while the conditions under which each maneuver was made is tabulated in Tables II and V. Due to flight difficulties the desired rudder and elevator angles given in Table I were not always obtained. The actual angles measured in flight are given in Tables II and V. The pressures over the tail surfaces are given in Table III, while those over the envelope are in Table VI. The resultant forces on the tail surfaces are given in Table IV and those on the envelope in Table VII.

In Table IV the resultant normal forces have been expressed in the coefficient form

$$C_{NF}=\frac{P}{1/2\,\rho\,V^2A}$$

where C_{NF} = absolute normal force coefficient.
P = load in lb.
A = area of surface.
ρ = air density.
V = true air speed.

The pressures over the tail surfaces were plotted for all runs along each row of holes at right angles to the longitudinal axis of the airship, as shown in Figures 9, 10, 11, 12, 13, 14, 15, and 16. As may be noted in these figures, at each row a curve was drawn of the pressures on each side of the surface and the resultant pressure curve for the row determined from the algebraic sum of these. The areas under these latter curves were measured and used as ordinates in drawing a resultant load curve for each surface. The center of area under each load curve was determined, and with the distance from that point to the center of buoyancy as an arm, the tail surface moment was computed. In all cases a positive load was considered to be acting from bottom to top on the horizontal surfaces and from starboard to port on the vertical surfaces.

To present the distribution of pressure over the hull, the values were plotted upon longitudinal cross sections of the envelope as shown in Figures 17, 19, 21, and 23, and also upon

circular cross sections at each station as in Figures 18, 20, 22, and 24. The resultant vertical and horizontal transverse forces at each station were obtained by numerical integration of the pressures around the envelope. These forces were plotted along the axis of the hull, giving one curve of horizontal forces and one of vertical forces. To these were added the horizontal and vertical loads upon the tail surfaces, thereby giving the total aerodynamic forces acting horizontally and vertically along the axis of the ship. These combined curves were drawn for each maneuver in the same manner as shown in Figures 25a, 25b, 26a, 26b, 27a, 27b, 28a, and 28b.

PRECISION

Experiments made by the National Advisory Committee on an airplane wing during the summer of 1921 and tests made in the United States Navy's Aerodynamical Laboratory showed that the type of pressure pads, Figure 1, used in this investigation gave the same reading of static pressure as a single hole orifice just flush with the surface. More recent experiments made in the National Advisory Committee wind tunnel to find the effect of the position of the connecting nipple showed that there was no change in pressure by moving the pad around from a position with the nipple directly aft to an angle of 90° to the air flow.

Tail surfaces.—The inertia effects in the pressure tubes were eliminated in these tests since only pressure differences, as measured through tubes of the same length and running side by side were used. The manometer was mounted close to the center of gravity of the airship and the vertical accelerations affecting the height of the liquid columns were neglected. The individual pressures are probably accurate to 0.10 lb./sq. ft. The accuracy of the figures given for the total forces is limited by the number of points investigated, because a curve was drawn connecting the individual pressures and the total forces were obtained by integrating the area under this curve. For this reason the total forces on the tail surfaces can not be assumed to be correct to better than ± 5 lb., because the changes in pressure between points were great.

Envelope.—The precision of results on the tail surfaces can not be applied to the pressures or total transverse forces on the envelope. The pressures over the envelope were of small magnitude and the distance between points of investigation was large. So that with the difficulty of measuring the small pressures and because of the fact that they were considered as acting over large areas, great errors might enter into the computation of the total forces.

It should be noted that the angles of pitch and yaw were measured relative to the car, and if applied to the envelope may be in slight error because of the flexibility of the suspension system. There was some difficulty experienced in measuring the angle of yaw because of the swinging of the suspended Pitot-static head on which sightings were taken. However, the readings obtained for steady conditions were correct to the nearest 0.2°. For nonsteady conditions the error may have been slightly greater, because it was difficult to observe the angle at exactly the same instant that the records were made. In determining the angle of flight path from the slope of the statoscope record and the air speed, the assumption was made that there were no vertical air currents or gusts, which was probably the case in all runs, except where the effects of a gust were desired, since the other tests were made over the water.

DISCUSSION OF RESULTS

The discussion of the results of this investigation is confined to a consideration of the actual pressures and total forces encountered in the different maneuvers. While all of the conditions enumerated in Table I were investigated, only those of each maneuver showing the greatest forces are tabulated here. However, the pressures encountered in all of the runs have been tabulated and these data are available at the National Advisory Committee for Aeronautics for reference.

Tail surfaces.—The results of the pressure distribution tests on the tail surfaces are given in Tables II, III, and IV, in which are tabulated the data recorded in flight, the pressures at each orifice, and the total resulting forces on the tail surfaces, respectively. It will be noted in the latter table that in circling flight the loads have been divided into the load on the fin and load on the movable surface only for bottom fin and rudder, and, conversely, in climbing

and descending flight only the horizontal surfaces have been so divided. Graphical presentation of the tail surface data for four runs is shown in Figures 9, 10, 11, 12, 13, 14, 15, and 16, which are representative of the manner in which all of the pressures were plotted for the determination of the resultant normal forces.

From the pressures at each orifice as tabulated in Table III the resultant force at each station may be obtained by the algebraic sum of the pressures on each side of each station. Local loads thus determined show that the largest value recorded for a horizontal surface was 5.7 lb./sq. ft. on the port elevator while flying through a gust. This value exceeded the largest pressure caused by any specific maneuver, which was 5.2 lb./sq. ft. near the leading edge of the starboard fin encountered during a steady descent at 46 M. P. H. Much larger values than these were recorded for the vertical surfaces where the peak pressures ranged from 5 to 7 lb./sq. ft. with a maximum of 7.3 lb./sq. ft. on the top fin during a steady circle at 35 M. P. H. (fig. 11). The largest local pressures were usually found at the leading edge of the fins close to the envelope and on the balancing portion of the rudder and elevators.

Examination of the results in Table IV shows that the greatest resultant forces were experienced on the vertical surfaces. This was to be expected, because more violent maneuvers were made in the horizontal plane than in the vertical. However, the loads recorded for the horizontal surfaces were much greater than those which would be experienced in normal flight, because the tests were made as severe as possible, without increasing the gas pressure in the envelope to a point where the fabric might fail. The greatest total normal force experienced on a complete tail surface was 352 pounds on the bottom fin and rudder in run 27–b, a reversal. Expressed in the coefficient form this becomes 0.316, which is also the largest C_{NF} obtained for a complete tail unit. In comparison with these the maximum normal force on a complete horizontal tail surface was 181 pounds with a maximum C_{NF} of 0.162. As would be expected, the same relation is true for the fixed surfaces where the largest force is found on the top fin, 311 pounds, or C_{NF} 0.554, while the largest on a horizontal fin was 200 pounds, or C_{NF} 0.210. Comparatively large forces were encountered on the rudder. A total force of 250 pounds was obtained in run 9–b and normal force coefficients of 0.550 to 0.570 were found on three different occasions. The maximum C_{NF} encountered on a complete tail unit, 0.316, is less than the value generally used in airship tail surface design, indicating that they are on the safe side.

Large horizontal moments of forces on the tail surfaces about the center of buoyancy were expected as a result of reversing the rudder from 24° port to 18° starboard and were found in the first and second records of the maneuver. In the case of the second, the value reached was 35,100 lb. ft. (Table VIII). The resultant force causing this moment was the largest found during the tests, 352 pounds on the lower fin and rudder and 180 pounds on the top fin, Figure 9.

The gust, which was encountered in run No. 28, apparently came from directly below and the pressures recorded are not those caused by the bump but those due to restoration of the ship to an attitude of normal flight. With the apparatus then available it was impossible to record the full effect of a bump because it was necessary to wait until the gust was felt and then make the record. However, the resultant forces 181 and 152 pounds and the normal force coefficients, 0.162 and 0.136 encountered on the port fin and elevator and starboard fin and elevator respectively, were the largest found on the horizontal surfaces. These forces, together with the observations made at the time of the test, indicate that there is a very great probability that the loads imposed by a bump or gust exceed those obtained in any maneuver.

One of the chief difficulties in these tests was caused by the inability, with the apparatus used, to obtain continuous records of the pressures and the subsequent doubt in regard to the maximum pressures. This limitation is brought out rather forcibly by the above discussion of the bump and is met with in many of the unsteady maneuvers as in the start of a turn. In the latter, runs 9–a and 9–b, it is evident from an inspection of the results in Table IV that the first run, 9–a, was made before the airship had started to turn and possibly before the rudder had moved an appreciable amount because the forces on both the vertical fin and the rudder were small. However, the second run, 9–b, shows greatly increased forces and indicates that the airship was turning. Because of the three seconds interval between records it is impossible to

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say exactly when the maximum forces were encountered and whether or not the forces obtained were the actual maximum forces. This, of course, would be eliminated by continuous records.

A further analysis of the results in Table IV shows a peculiar condition in that the load on the tail surfaces was not equally divided between the port and starboard surfaces, or the top and bottom surfaces. An example of this is run 21, where the starboard surfaces have a down load of 73 pounds, while the port surfaces have 146 pounds. This same thing is noted to a greater or less extent throughout the whole series of tests and is only explainable by the possibility that the pressures were obtained while the airship was rolling. It was observed during the flights that most of the maneuvers were accompanied by a rolling motion of the airship.

Envelope.—The results of the pressure distribution tests on the envelope are given in Tables V, VI, and VII, and a graphical presentation of the pressures for four runs, a reversal of controls from 24° port to 18° starboard, a steady circle at 37.5 M. P. H. with 8° starboard rudder, start of a circle at 41.5 M. P. H. with 44° starboard rudder, and a bump at 45 M. P. H. is given in Figures 17 to 24, inclusive. These figures are representative of the manner in which all of the data were plotted.

The curve of the pressure distribution over the envelope did not change greatly with the different maneuvers. The values of pressure were positive in all cases from the nose back about 7 per cent of the length of the airship, where they became negative and remained so along the hull to a region about 10 per cent of the airship's length from the tail. Here again the pressure became positive and continued so to the end of the airship. This is about the same general pressure distribution that was obtained on a model of the *C–2* at 0° yaw in the wind tunnel at the Bureau of Standards. The only radical departure from this general distribution was found in run No. 5 in the region close to the nose. In this region the values changed sign several times and as the photographic record was poor, making it difficult to read the values, these data are considered doubtful.

When the envelope results are considered for the purpose of determining the total aerodynamic loading of the airship they are found to be very unsatisfactory. There are several causes which contribute to the inaccuracy of the envelope results, the chief of these being the relatively small number of points investigated on such a large area as that of the envelope. This, of course, causes each orifice to be considered as representative of the pressure over a considerable area and magnifies the inherent errors of such an investigation which are imposed by the irregularities of the envelope and the interference of wires, pads, tubing, and nose battens that undoubtedly produces disturbances at some of the orifices. This could only be eliminated by a much greater number of orifices which would probably run into prohibitive weight and resistance.

That the aerodynamic forces as measured are not representative of the forces encountered is shown in Figures 29 and 30 in which the transverse forces as measured in Runs 4 and 1 are plotted, together with the theoretical forces for the same runs as computed according to Munk's formula (Reference 3):

$$dF=dx\left[(k_2-k_1)\frac{dS}{dx}V^2\frac{\rho}{2}\sin 2\varphi+k'V\frac{\rho}{r}S\cos\varphi+k'V^2\frac{\rho x}{r}\frac{dS}{dx}\cos\varphi\right]$$

where k_2-k_1 = difference of transverse and longitudinal apparent mass coefficients.

S = cross sectional area

φ = angle of yaw

k' = inertia coefficient

r = radius of turn

x = distance to the areodynamic center.

NOTE.—The radius of turn, r, was computed from the time for a complete turn as clocked by a stop watch, and the air speed. This value was checked by using the equation given in the British Advisory Committee Report No. 749,

$$r\sin\varphi = 0.9l$$

where l is the distance from the center of pressure on the fins to the $c.\ g.$ of the airship.

The computed forces as plotted in Figures 29 and 30 are not expected to agree exactly with those measured because motion in a perfect fluid was assumed for the computations, but no great descrepancies as are shown could exist and this is a further indication of the unreliability of the aerodynamic loading obtained on the envelope.

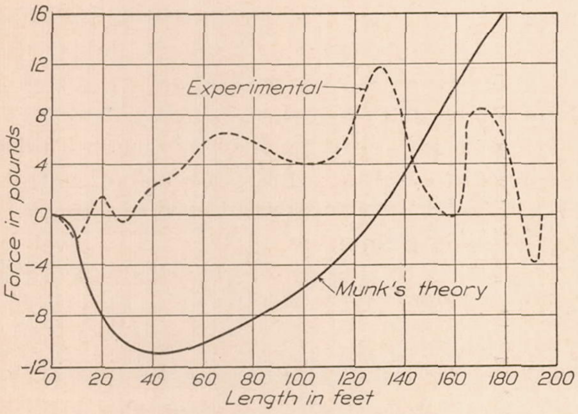

FIG. 29.—Steady circular flight, run No. 4

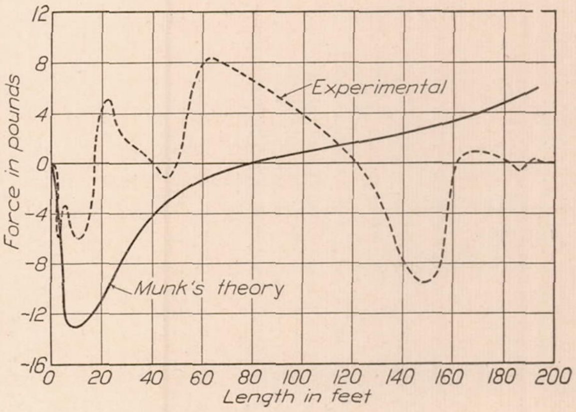

FIG. 30.—Horizontal flight, run No. 1

Theoretical and experimental pressure distribution on the "C-7" airship

CONCLUSIONS

Since the results are scattered throughout such extensive tables, it is thought advisable in conclusion to again summarize some of the more important of them, as follows:

(1) The maximum total load on a complete tail surface was 352 pounds, occurring on the bottom fin and rudder (fig. 9), during a reversal at 40.5 M. P. H., when the rudder was moved from 24° port to 18° starboard. The corresponding normal force coefficient, C was 0.316.

(2) The maximum total load on a fixed surface was found to be 311 pounds, and occurred on the top fin (fig. 11) during a steady circle at 35 M. P. H. with the rudder 44° to starboard. This resulted in a normal force coefficient, $C_{NF}=0.554$.

(3) The maximum total load on a movable surface was 250 pounds, and occurred on the rudder (fig. 13) at the start of a turn at 45 M. P. H. with the rudder 44° to starboard. The average pressure over the surface in this case was 2.9 lb./sq. ft. or $C_{NF}=0.565$, and was the largest encountered on any surface during any maneuver.

(4) Large local pressures, ranging from 3 to 7 lb./sq. ft., were encountered, usually on the leading edge of the top fin close to the envelope and on the balancing portion of the rudder and elevators. The largest pressure of this kind was 7.3 lb./sq. ft. on the top fin during a steady circle at an air speed of 45 M. P. H. with the rudder 44° to starboard.

(5) The maximum moment of the tail surface loads about the center of buoyancy was 37,200 lb. ft. and occurred in a steady circle at 35 M. P. H. with the rudder 44° to starboard.

(6) The loads on the envelope were relatively small, the maximum loads ranging from 16 to 18 pounds per running foot along the axis of the ship.

(7) Due to the large areas and small pressures encountered, any irregularity in the hull or slight error in the reading of the pressures would cause a large error in the load per running foot on the envelope. This fact tends to make a complete investigation of the envelope pressures for the purpose of finding aerodynamic forces impracticable, because it is obvious that sufficient points to eliminate this difficulty could not be taken without running into excessive weight and resistance. It is felt, therefore, that the results of the tests on the envelope while showing the general distribution of pressure sufficiently well are practically useless in the determination of total aerodynamic forces on the airship.

(8) Although the pressures actually measured in a bump (figs. 15, 16, 23, 24, 27a, and 27b) were of the same general magnitude as in the other conditions it is felt that the pressures set up by a bump are larger than those obtained in maneuvering.

In general, the tests on the tail surfaces produced valuable data covering the loads and coefficients encountered in flight which confirm the theoretical values used in design.

The investigation of the pressures on the hull, while producing some interesting information relative to general distribution of the pressures, was unsatisfactory for the purpose of finding the aerodynamic loading on the airship. It would seem that such an investigation is unlikely to produce any results of particular value unless possibly on a rigid ship where the resistance of the necessary tubing would be avoided by securing it inside of the envelope. Even with a rigid ship it is felt that such an investigation is impracticable because of the great number of points that it is necessary to investigate and the expense, bulk, and weight of the apparatus required.

For further tests of this nature a pressure recorder giving continuous records is recommended.

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TABLE I

LIST OF MANEUVERS INVESTIGATED FOR PRESSURE DISTRIBUTION

Run No.	Maneuver	R. P. M.	Rudder angle (degrees)	Elevator angle (degrees)	Run No.	Maneuver	R. P. M.	Rudder angle (degrees)	Elevator angle (degrees)
1	Horizontal flight	1, 250	----------		15	Start climb	1, 000	----------	19 U.
2	Steady circle	1, 000	8 R.		16	do	1, 250	----------	12 U.
3	do	1, 000	44 R.		17	do	1, 250	----------	19 U.
4	do	1, 250	8 R.		18	Steady descent	1, 000	----------	11 D.
5	do	1, 250	44 R.		19	do	1, 000	----------	18 D.
6	Start circle	1, 000	8 R.		20	do	1, 250	----------	11 D.
7	do	1, 000	44 R.		21	do	1, 250	----------	18 D.
8	do	1, 250	8 R.		22	Horizontal flight light	1, 000	----------	----------
9	do	1, 250	44 R.		23	do	1, 250	----------	6 D.
10	Steady climb	1, 000	----------	12 U.	24	Rising light	1, 000	----------	----------
11	do	1, 000	----------	19 U.	25	do	1, 250	----------	----------
12	do	1, 250	----------	12 U.	26	Reversal	1, 000	24 L. to 18 R.	
13	do	1, 250	----------	19 U.	27	do	1, 250	24 L. to 18 R.	
14	Start climb	1, 000	----------	12 U.	28	Bump	1, 250	----------	

TABLE II

PRESSURE DISTRIBUTION TESTS ON TAIL SURFACES

[Table of Data]

	Run No. 1	Run No. 2	Run No. 4	Run No. 5	Run No. 9a	Run No. 9b	Run No. 13	Run No. 17a	Run No. 17b
Wind direction	SE.	SE.	SE.	WNW.	WNW.	WNW.	SE.	SE.	SE.
Wind velocity (M. P. H.)	13	13	13	4	4	4	13	9	9
Air in balloonets (cu. ft.)	3, 500	3, 500	4, 000	1, 000	1, 500	1, 500	4, 500	2, 000	2, 000
Static condition (lb. light)	30	30	Equilib.	50	Equilib.	Equilib.	Equilib.	Equilib.	Equilib.
R. P. M. starboard	1, 250	1, 000	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250
R. P. M. port	1, 250	1, 000	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250
Gas pressure (inches of water)	1⅝	1¼	1½	1½	1⅝	1⅝	1⅜–2	1¼–2	1¼–2
Rudder angle (degrees)	0	5 R.	5 R.	18 R.	18 R.	18 R.	0	0	0
Elevator angle (degrees)	0	0	0	0	0	0	12 U.	12 U.	12 U.
Air speed (knots)	45. 5	31	41	35	45	45	39. 5	45	45
Compass course (degrees)	130	Various.	Various.	Various.	Various.	Various.	135	----------	----------
Inclination (degrees)	0	0	−1. 0	−1. 0	0	0	13 U.	0	0
Barometric pressure (at manometer)	29. 92	29. 94	29. 90	29. 73	29. 70	29. 71	29. 95	29. 86	29. 81
Temperature (° F.)	48	48	48	46	46	46	48	53	53
Air density	0. 00242	0. 00243	0. 00243	0. 00242	0. 00241	0. 00241	0. 00243	0. 00240	0. 00240
Corrected rudder angle (degrees)	0	8 R.	8 R.	44 R.	44 R.	44 R.	0	0	0
Corrected elevator angle (degrees)	0	0	0	0	0	0	19 U.	19 U.	19 U.
Corrected air speed (M. P. H.) (N. A. C. A. recording instrument)	47. 0	36. 5	41. 0	35	45. 5	45. 5	42. 0	48. 0	46. 5
Angle of yaw (degrees)	2.9 R.	5.9 R.	7.4 R.	6.0 R.	4.5 R.	4.5 R.	2.1 L.	1.5 R.	1.5 R.
Fore and aft inclination (degrees)	−5. 2	+2. 4	−3. 2	−1. 4	−3. 6	−4. 2	+10. 2	+0. 6	+6. 0
Inclination of flight path (degrees)	−1. 4	+2. 6	00	+1. 7	00	0	+7. 8	+2. 2	+7. 2
Angle of pitch (degrees)	−3. 8	−. 2	−3. 2	−3, 1	−3. 6	−4. 2	+2. 4	−1. 6	−1. 2
Time of complete turn (minutes)	----------	2. 52	1. 03	1. 11	----------	----------	----------	----------	----------

	Run No. 21	Run No. 23	Run No. 25	Run No. 27a	Run No. 27b	Run No. 27c	Run No. 27d	Run No. 28
Wind direction	WNW.	W.	W.	WNW.	WNW.	WNW.	WNW.	WNW.
Wind velocity (M. P. H.)	4	8	8	4	4	4	4	4
Air in balloonets (cu. ft.)	1, 500	1, 000	1, 000	1, 500	1, 500	1, 500	1, 500	1, 500
Static condition (lb. light)	Equilib.	525	525	Equilib.	Equilib.	Equilib.	Equilib.	Equilib.
R. P. M. starboard	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250
R. P. M. port	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250
Gas pressure (inches of water)	1¾–1¼	1⅝	1⅜–1⅝	1⅝	1⅝	1⅝	1⅝	1¼–2
Rudder angle (degrees)	0	0	0	10L.–10R.	10L.–10R.	10L.–10R.	10L.–10R.	3L.–8 R.
Elevator angle (degrees)	12 D.	4 D.	0	0	0	0	0	3 D.
Air speed (knots)	41	42	44	38	38	38	38	43–45
Compass course (degrees)	280	270	270	Various.	Various.	Various.	Various.	220
Inclination (degrees)	17 D.	8 D.	1	1	1	1	1	10 D.–4 U.
Barometric pressure (at manometer)	29. 78	29. 78	29. 78	29. 70	29. 70	29. 70	29. 70	29. 83
Temperature (° F.)	45	49	49	46	46	46	46	45
Air density	0. 00243	0. 00241	0. 00241	0. 00242	0. 00242	0. 00242	0. 00242	0. 00244
Corrected rudder angle (degrees)	0	0	0	24L.–18R.	24L.–18R.	24L.–18R.	24L.–18R.	5½L.–13R.
Corrected elevator angle (degrees)	18D.	6 D.	0	0	0	0	0	4 D.
Corrected air speed (M. P. H.) (N. A. C. A. recording instrument)	46	43	47	40. 0	40. 5	41. 5	42	42. 5
Angle of yaw (degrees)	1.5 R.	1.8 L.	2.2 R.	0–7 R.	0–7 R.	0–7 R.	0–7 R.	----------
Fore and aft inclination (degrees)	−5. 0	−3. 2	−2. 2	−0. 2	−1. 6	−3. 2	−4. 4	−5. 8
Inclination of flight path (degrees)	−3. 3	0	+2. 2	+2. 45	0	0	0	−3. 9
Angle of pitch (degrees)	−1. 7	−3. 2	−4. 4	−2. 65	−1. 6	−3. 2	−. 6	−2. 1

TABLE III

PRESSURE DISTRIBUTION ON THE TAIL SURFACES

[Pressures lb./sq. ft.]

Surface	Pad	Run No. 1	Run No. 2	Run No. 4	Run No. 5	Run No. 9a	Run No. 9b	Run No. 13	Run No. 17a	Run No. 17b	Run No. 21	Run No. 23	Run No. 25	Run No. 27a	Run No. 27b	Run No. 27c	Run No. 27d	Run No. 28
Starboard fin and elevator, upper side	1-A	−1.30	−0.60	−0.65	−0.45	−1.10	−0.30	−2.75	−3.20	------	+0.80	−0.65	−0.90	−0.85	−0.60	−0.40	−0.80	+0.10
	2-A	−.40	−.20	.00	−.10	−.20	+.30	−.45	−.50	−0.10	.00	−.10	.00	−.30	−.15	.00	−.20	+.10
	2-B	−.65	−.30	−.15	−.10	−.60	+.10	−1.00	−1.20	−.40	+.10	−.30	−.40	−.40	−.30	−.25	.−35	+.05
	2-C	−1.00	−.55	−.45	−.20	−1.00	−.20	−1.70	−1.90	−.85	.00	−.80	−.90	−1.00	−.90	−.40	−.70	−.10
	3-A	−.35	−.20	−.10	+.10	−.40	+.35	−.20	−.15	−.30	−.35	−.30	.00	−.30	−.20	.00	−.20	.00
	3-B	−.40	.00	+.10	.00	−.35	+.40	−.20	−.30	−.20	−.45	−.30	−.20	−.40	−.10	.00	.00	−.05
	3-C	−.50	−.15	.00	−.10	−.60	−.50	−.90	−.70	−.55	−.55	−.40	−.40	−.55	−.40	−.25	−.20	−.80
	4-A	+.10	.00	.00	+.10	−.05	+.50	+.15	+.20	−.10	.00	−.10	+.10	−.20	−.10	+.10	.00	+.30
	4-B	+.10	.00	+.20	+.25	−.10	+.70	+.15	+.10	−.10	.00	−.10	+.20	−.20	−.10	.00	.00	+.40
	4-C	+.10	+.05	+.35	------	−.05	+.70	−.60	−.40	.00	−.10	.00	+.10	−.40	−.10	+.20	.00	+.25
	5-A	+.10	+.15	+.20	+.35	−.10	+.60	+.40	+.50	−.20	−.65	.00	+.10	−.30	−.20	.00	.00	+.20
	5-B	.00	.00	+.20	+.10	−.40	+.40	+.25	+.50	−.85	−1.10	−.30	−.10	−.40	−.30	−.10	.00	+.30
	5-C	−.30	−.25	−.15	+.10	−.70	+.45	−.70	−.60	−1.60	−1.00	−.40	−.60	−.85	−.70	−.25	−.10	+.70
	5-D	+.65	−.15	−.10	−.20	−.40	+.20	−.30	+.60	−2.70	−1.30	+.10	−.20	−.70	−.70	−.20	−.50	+1.40
	6-A	+.10	−.10	.00	.00	−.40	+.40	−.55	+.70	−1.40	−2.00	−.40	−.30	−.70	−.60	−.30	−.20	+.30
	6-B	−1.10	−.70	−.80	−.50	------	------	−.30	−.20	−1.50	−2.00	------	−1.40	−1.50	------	−.90	−.80	−.80
	6-C	.00	−.10	−.20	−.10	−.65	+.10	−.45	−.10	−1.90	−2.00	−.60	−.50	−1.10	−.90	−.60	−.60	------
	6-D	−.85	−.55	−.50	−.40	−1.15	−.40	−.80	−.50	−1.80	−1.80	−1.00	−.90	−1.25	−1.10	−.85	−1.10	+.10
	7-A	−.20	−.20	.00	−.10	−.40	+.50	+.30	+.45	−.80	−1.10	−.50	−.30	−.60	−.40	.00	−.10	+.10
	7-B	−.10	.00	+.10	+.20	------	+.50	+.30	+.40	−.50	------	−.25	−.20	−.40	------	−.05	−.10	+.20
	7-C	−.10	−.10	+.10	+.15	−.60	+.40	−.45	−.50	−1.20	−1.40	−.35	−.40	−.70	−.60	−.30	−.10	+.10
	7-D	−.70	−.15	−.10	+.15	−.65	+.20	−.30	−.40	−1.20	−1.00	−.55	−.50	−1.00	−.70	−.60	−.50	+.10
	8-A	−.50	+.10	+.20	+.20	−.25	+.60	+.20	+.20	−.30	−.90	−.20	.00	−.40	−.20	+.10	.00	−.20
	8-B	−.60	−.10	.00	−.15	−.40	+.40	+.10	.00	−.40	−.80	−.50	−.20	−.40	−.20	−.20	−.10	------
	8-C	−.45	−.10	+.15	+.20	−.30	+.50	−.60	−.70	−.75	−.70	−.45	−.20	−.60	−.40	−.10	−.10	−.20
	8-D	−.80	+.15	.00	−.10	−.50	+.80	+.10	−.20	−.90	−1.00	−.45	−.50	−1.00	−.60	−.50	−.40	−.45
Starboard fin and elevator, lower side	1-A	−1.70	−.55	−.60	− .35	−1.60	−.50	+.50	+.50	−1.80	−4.50	−2.10	−1.10	−1.90	−1.70	−1.20	−.40	−1.50
	2-A	−.65	.00	−.20	−.20	−.40	+.30	+.35	+.20	−.70	−1.75	−.90	−.10	−1.10	−.50	−.50	------	−.50
	2-B	−1.00	−.30	−.35	−.25	−1.00	−.10	+.20	+.20	−1.20	−2.30	−1.20	−.60	−1.30	−.90	−.60	+.70	−.50
	2-C	−1.70	−.35	−.45	−.30	−1.75	−.30	+.30	−.50	−1.50	−3.00	−1.60	−.85	−1.45	−1.30	−.90	−.80	−1.20
	3-A	−.40	.00	.00	−.10	−.20	+.50	+.20	+.25	−.30	−.80	−.40	.00	−.60	−.30	.00	+.10	+.30
	3-B	−.50	.00	.00	+.10	−.40	+.55	+.50	−.10	−.20	−1.10	−.60	.00	−.75	−.40	−.10	+.10	−.10
	3-C	−1.10	.00	−.20	−.10	−.55	+.50	.00	−.30	−.80	−1.85	−.95	−.10	−.95	−.60	−.20	------	−.05
	4-A	−.60	−.10	−.10	.00	−.30	+.70	+.15	.00	−.20	−.60	−.50	.00	−.50	−.05	+.10	+.20	−.10
	4-B	−.30	+.10	+.20	+.15	.00	+.70	+.60	------	------	−.50	−.20	+.30	−.50	−.10	+.15	------	−.10
	4-C	−1.00	.00	.00	+.20	.00	+.70	.00	+.30	.00	−2.00	−.35	+.20	−.40	−.20	+.15	+.40	−.25
	5-A	−.70	−.10	−.15	−.20	−.25	+.45	−.20	−.40	−.10	−.30	−.35	+.20	−.60	−.20	.00	.00	.00
	5-B	−.60	.00	.00	.00	−.30	+.40	−.30	−.40	+.50	−.25	−.45	−.20	−.70	−.40	−.10	+.10	−.50
	5-C	−1.50	−.35	−.30	−.20	−.90	+.10	−.20	−.50	.00	−1.50	−1.15	−.80	−1.30	−.70	−.40	.00	−1.40
	5-D	+.90	−1.10	+1.10	+.20	−.15	+.45	+.65	−.30	+1.90	−.10	−1.10	−.80	+.95	+1.10	+1.10	+1.80	−2.10
	6-A	−.90	−.35	−.30	−.20	−.60	+.45	−.80	−1.00	+.60	+.10	−.70	−.50	−.80	−.40	+.10	+.10	−.80
	6-B	−1.50	−.45	−.30	−.40	−1.00	+.20	−1.30	−1.35	+.70	+.10	−1.30	−.85	−.90	−.50	−.10	−.20	−1.30
	6-C	------	−.40	+.50	−.40	−1.00	+.50	------	−1.40	+1.00	−1.35	−1.30	−.90	−.85	−.60	−.10	.00	−1.50
	6-D	−2.10	−.65	−.60	−.30	−1.50	−.50	−.80	−1.20	−.10	−1.55	−1.80	−1.10	−1.40	−1.00	−.75	−.70	−1.00
	7-A	−.80	−.30	−.25	.00	−.30	+.50	−.60	−.55	+.15	−.10	−.40	−.35	−.60	−.40	.00	+.25	−.30
	7. B	−.80	−.20	.00	.00	−.60	+.50	−.40	−.70	+.30	−.20	−.45	−.35	−.70	−.20	.00	+.10	−.50
	7-C	−.70	.00	+.15	.00	−.40	+.50	−.60	------	------	−1.40	−.60	−.15	−.70	−.30	+.20	+.10	−1.50
	7-D	−1.20	−.30	−.25	.00	−.60	+.20	−.40	−.50	.00	−.90	−.90	−.50	−1.00	−.50	−.20	.00	−.85
	8-A	−.40	------	.00	.00	−.10	+.85	−.25	−.30	−.20	+.80	−.20	+.20	−.60	−.20	+.30	+.20	+.75
	8-B	−.30	.00	+.10	+1.00	−.85	+.30	−1.00	−.80	+.65	−.20	−1.15	−.90	+1.50	+1.90	+2.10	+1.30	+.80
	8-C	+1.50	−.65	+2.20	+.60	−.80	−.20	+.45	−.70	+.60	+.20	+.15	−.50	+1.10	+1.20	+1.20	+1.10	+.40
	8-D	−.20	−.70	+2.90	+1.10	−.80	−.40	+.10	−.60	+1.00	−.35	−.35	−.20	+1.30	+1.00	+.70	+1.20	+.55

TABLE III—Continued

PRESSURE DISTRIBUTION ON THE TAIL SURFACES—Continued

[Pressure lb./sq. ft.]

Surface	Pad	Run No. 1	Run No. 2	Run No. 4	Run No. 5	Run No. 9a	Run No. 9b	Run No. 13	Run No. 17a	Run No. 17b	Run No. 21	Run No. 23	Run No. 25	Run No. 27a	Run No. 27b	Run No. 27c	Run No. 27d	Run No. 28
Port fin and elevator, upper side	1-A	------	-1.70	-2.00	-1.85	-1.25	-1.50	-2.80	------	-0.90	-0.10	-0.60	-1.10	-0.20	-0.45	-0.60	-1.85	-0.70
	2-A	-0.70	-.70	-.70	+.65	-.40	-.60	-.60	-0.85	-.20	-.30	-.40	-.20	+.10	-.25	-.50	-1.00	-.50
	2-B	-.80	-.80	-.90	-.90	-.45	-.65	-.80	-1.20	-.40	.00	-.45	-.30	+.30	-.10	-.30	-.70	-.30
	2-C	-1.00	-1.30	-1.40	-1.40	-1.00	-1.40	-1.60	-2.20	-.85	-.50	-.95	-1.00	------	-.80	-.70	-1.45	-.70
	3-A	-.40	-.60	-.50	-.50	-.20	-.30	-.10	-.10	.00	-.25	-.30	+.10	+.15	-.15	-.30	-1.00	-.10
	3-B	-.50	-.60	-.50	-.55	-.30	-.50	-.15	-.30	-.10	-.30	-.30	-.20	+.35	-.20	-.30	-.80	-.30
	3-C	------	-.95	-1.10	-1.05	-.60	-1.00	-.85	-1.10	-.55	-1.10	-.50	-.40	-.10	-.65	-.70	-1.10	-.80
	4-A	------	-.50	-.40	-.50	-.20	-.50	+.30	.00	+.20	-1.05	-.25	.00	.00	-.40	-.30	-.65	-.45
	4-B	-.40	-.50	-.60	-.55	-.10	-.40	+.30	+.10	.00	-.30	-.10	-.10	+.20	-.10	-.25	-.40	-.05
	4-C	.00	-.35	-.50	-.70	+.25	-.10	-.50	-.90	+.20	-.35	-.05	+.30	+.15	-.40	-.20	-1.30	+.10
	5-A	-1.10	-.90	-1.00	-.90	-.90	-1.20	-.05	-.35	-.75	-1.70	-.75	-.50	-.55	-.90	-.90	-1.00	-.60
	5-B	------	-.50	-.65	-.60	-.40	-.70	+.30	+.35	-.50	-1.40	-1.50	-.10	+.10	-.60	-.65	-.70	.00
	5-C	-.10	-1.00	-1.10	-1.40	-.35	-1.00	.00	-.10	-1.20	-1.00	-.30	-.50	.00	-.70	-.70	-1.20	-.20
	5-D	+.60	-.60	-.85	-.80	.00	-.30	+.35	+.40	-2.10	-1.30	+.20	-.10	+.25	-.40	-.25	-.80	+1.60
	6-A	-.40	-.70	-.90	-1.00	-.60	-1.10	+.55	+.70	-1.30	-2.20	-.60	-.40	-.50	-1.00	-.90	-1.10	+.05
	6-B	+.10	-.60	-.80	-.70	-.40	-.90	+1.00	+1.10	-1.80	-2.15	-.50	-.30	-.30	-1.00	-1.20	-1.00	+.40
	6-C	-.90	-1.00	-1.25	-1.60	-.65	-1.10	-1.25	.00	-1.90	-2.45	-.65	-.75	-.40	-1.20	-1.40	-1.30	+.55
	6-D	-.85	-.90	-1.50	-1.55	-1.00	-1.10	+.55	-.70	-2.10	-1.40	-1.40	-1.20	-.70	-.40	-1.10	-1.60	+.50
	7-A	-.20	-.55	-.60	-.70	-.40	-.80	+.65	+.70	-.55	-1.30	-.30	-.20	-.10	-.70	-.80	-.80	+.05
	7-B	.00	-.50	-.60	-.70	-.10	-.70	+.75	+.85	-.80	-1.40	-.50	-.10	-.20	-.65	-.60	------	+.20
	7-C	.00	-.75	-.85	-1.40	-.45	-.90	-.30	-.50	-1.40	-1.70	-.65	-.30	-.40	-.90	-.90	-.90	+.30
	7-D	-.40	-.90	-1.20	-1.20	-.30	-1.00	+.40	+.20	-1.00	-1.30	-.60	-.50	-.20	-.90	-.70	-1.10	-.20
	8-A	-.70	-.75	-.70	-.95	-.30	-.90	+.20	+.30	-.60	-1.10	-.50	-.15	-.35	-.80	-.60	-.80	-.45
	8-B	-.70	-.65	-.65	-.80	-.30	-.80	+.10	.00	-.90	-1.30	-.70	-.20	-.10	-.80	-.55	-.80	-.75
	8-C	-.50	-.60	-.65	-.90	-.20	-.80	-.05	-.60	-.80	-1.20	-.40	-.20	-.10	-.70	-.70	-.80	-.50
	8-D	-.40	-.70	-.90	-1.00	-.20	-.80	+.35	+.30	-.70	-.90	-.50	-.20	-.10	-.60	-.70	-.80	-.30
Port fin and elevator, lower side	1-A	-1.10	-.65	-.75	-.60	-1.25	-1.90	+.85	+1.30	-1.20	-4.45	-2.00	-1.00	-.90	-1.50	-2.00	-1.00	-1.20
	2-A	-.50	-.35	-.40	-.30	-.50	-.70	+.40	+.50	-.60	-1.30	-.90	-.40	-.20	-.50	-.60	-.50	-.40
	2-B	-.10	-.60	-.65	-.50	-1.00	-1.10	+.30	+.50	-1.10	-1.95	-1.30	-.70	-.60	-.95	-1.10	-.70	-.90
	2-C	-1.20	-.55	-.60	-.40	-.90	-1.30	+.25	+.50	-.80	-2.65	-1.50	-1.00	-.70	-1.30	-1.35	-1.00	-1.20
	3-A	-.60	-.40	-.35	-.30	-.30	-.50	+.15	+.30	-.20	-.90	-.75	-.30	-.20	-.45	-.45	-.50	-.30
	3-B	-.70	-.50	-.55	-.50	-.55	-.70	+.15	+.20	-.40	-.10	-.80	-.30	-.30	-.55	-.75	-.70	-.50
	3-C	-.90	-.60	-.60	-.40	-.65	-1.00	.00	.00	-.50	-1.90	-1.00	-.50	-.40	-.75	-.90	-.80	-.80
	4-A	-.70	-.60	-.50	-.60	-.45	-.80	+.10	+.20	-.10	-.60	-.70	-.40	-.20	-.40	-.60	-.60	-.40
	4-B	-.60	-.40	-.40	-.45	-.10	-.60	+.45	+.50	+.30	-.90	-.55	.00	-.10	-.40	-.50	-.40	-.40
	4-C	-.10	-.20	-.20	-.20	.00	-.40	+.50	+.40	+.10	-1.75	-.30	+.10	+.10	-.35	-.40	-.35	-.20
	5-A	-.60	-.60	-.65	-.75	-.35	-.90	-.10	-.30	+.10	-.30	-.50	-.20	-.20	-.60	-.50	-.70	-.45
	5-B	-1.40	-.70	-.80	-1.15	-.40	-.90	+.15	-.40	+1.00	-1.00	-1.20	-.60	-.10	-.50	-1.00	-.90	-.95
	5-C	-1.40	-.70	-.70	-.90	-.70	-1.30	.00	-.10	+.50	-1.00	-1.20	-.60	-.40	-.90	-1.30	-1.00	-2.00
	5-D	-1.60	-.80	-.50	-.60	-.90	-1.40	-.30	-.45	+1.80	-.90	-1.60	-.40	-.70	-1.00	-1.10	-.70	-4.10
	6-A	-1.00	-.90	-1.00	-1.10	-.60	-1.25	-.60	-.90	+.20	-.10	-.90	-.45	-.40	-.70	-.80	-1.00	-1.10
	6-B	-2.00	-1.20	-1.25	-1.45	-1.05	-1.60	-1.25	-1.20	+1.00	+.10	-1.40	-1.15	-.50	-.90	-1.00	-1.20	-1.75
	6-C	-2.30	-1.40	-1.45	-1.60	-1.40	-2.00	-1.20	-1.45	+.40	-.70	-2.00	-1.30	-.80	-1.50	-1.60	-2.10	-1.90
	6-D	------	-1.40	-1.50	-1.30	-1.65	-2.10	-1.00	-1.15	-.50	-1.60	-2.00	-1.60	-1.00	-1.40	-1.70	-1.70	-1.50
	7-A	-1.00	-.75	-.80	-.90	-.55	-1.00	-.40	-.50	.00	-.40	-.70	-.40	-.45	-.80	-.85	-1.10	-.80
	7-B	-.80	-.70	-.70	-.90	-.50	-.80	-.20	-.50	+.30	-.10	-.75	-.35	-.10	-.60	-.70	-.90	-1.00
	7-C	-1.20	-.80	-.80	-1.05	-.50	-1.10	-.35	-.60	+.50	-1.15	-1.00	-.70	-.30	-1.00	-.90	-1.00	-1.40
	7-D	-.80	-.60	-.20	-.90	-.50	-1.10	-.25	-.50	+.40	-.90	-1.00	+.20	+.15	-.90	-1.10	-.80	-1.10
	8-A	-.50	-.70	-.75	-.90	-.30	-.50	+.60	-.20	+1.00	-.90	-.20	-.20	+.10	-.20	-.70	-1.00	-.60
	8-B	-.70	-.55	-.70	-1.10	-.15	-.60	+.30	-.35	-.10	-.90	-.50	+.10	-.40	-.70	-.80	-.90	-.70
	8-C	-.50	-.50	-.65	-.85	-.15	-.70	+.25	-.20	-.10	-1.40	-.50	-.25	.00	-.70	-.80	-.80	-1.05
	8-D	-.90	-.85	-.90	-1.00	-.50	-1.30	.00	-.30	-.30	-.70	-.90	-.50	-.30	-.80	-1.00	-1.10	-1.00
Lower fin and rudder, port side	1-A	-1.10	+.70	+.75	+1.20	-.50	+1.40	-1.30	-.85	-1.80	-.95	-1.20	-.60	+1.30	-.80	+.35	+1.10	-.45
	2-A	-.90	.00	-.20	+.20	-.30	+.10	-.40	-.40	-1.00	-.70	-.80	-.40	+1.10	-.70	-.25	+.05	-.60
	2-B	-.80	+.10	+.10	-.35	-.40	+.55	-.60	-.70	-1.10	-.60	-.85	-.50	-1.90	-.80	-.10	+.30	-.40
	2-C	-1.50	-.10	-.10	+.40	-1.00	+.15	-.65	-1.15	-1.20	-.95	-1.10	-.80	-2.30	-1.50	-.50	-.05	-.75
	3-A	-.10	-.15	-.10	-.20	-.40	-.15	+.45	-.50	-.70	-.60	-.75	-.40	-.90	-.90	-.50	-.30	-.60
	3-B	-.90	-.30	-.25	00	-.30	-.10	-.45	-.40	-.85	-.50	-.45	-.25	-1.00	-.60	-.50	-.40	-.35
	3-C	-1.30	-.40	-.40	-.30	-.50	-.20	-.55	-.80	-.90	-.65	-.80	-.60	-1.75	-1.10	-.50	-.20	-.55
	4-A	-.70	-.20	-.25	-.10	-.30	-.25	-.40	-.30	-.65	-.40	-.35	-.10	-.80	-.80	-.40	-.20	-.30
	4-B	-.50	-.20	-.10	-.10	-.30	-.05	-.35	-.40	-.60	-.20	-.50	-.10	-1.00	-.70	-.40	-.25	-.20
	4-C	-.50	-.20	-.25	-.10	-.10	+.20	-.25	-.10	-.40	-.20	-.30	00	-1.90	-.65	-.10	00	-.20
	5-A	-.70	-.40	-.50	-.80	-.50	-.90	-.35	-.40	-.40	-.10	-.20	+.10	-.70	-.90	-.70	-.70	-.20
	5-B	-.80	-.50	-.40	-.90	-.60	-.70	-.30	-.40	-.35	-.20	-.40	-.10	-1.00	-1.00	-.80	-.80	-.25
	5-C	-1.10	-.20	-.20	-1.00	-1.30	-1.00	-.80	-1.00	-.65	-.45	-.90	-.60	-2.20	-2.50	-1.40	-.70	-.30
	5-D	-.30	+.15	+.35	-4.60	-3.20	-3.65	-.85	-.10	-.80	-.80	-1.00	-.50	-5.30	------	-2.60	-1.40	+1.00
	5-E	-.20	-.20	.00	-3.90	-2.80	-3.60	-.65	-.10	-.90	-.90	-.95	-.60	------	------	-2.60	-1.40	+.20
	6-A	-.90	-.95	-1.00	-.70	------	------	-.85	-.75	-.60	------	------	------	------	------	------	-1.70	------
	6-B	-.80	-1.00	-1.30	-1.70	-1.30	-2.00	-.75	-.70	-.60	-.45	-.50	-.50	-1.80	-2.50	------	-2.30	-.40
	6-C	-1.20	-.95	-1.10	-1.95	-2.00	-2.50	-.90	-1.15	-.80	-.90	-1.00	-.95	-1.90	-2.70	-2.00	-2.00	-.60
	6-D	-1.70	-.80	-.80	-1.85	-2.30	-2.00	-1.05	-1.30	-1.15	-.90	-1.60	-1.40	-1.80	-2.10	-1.90	-1.00	------
	6-E	-.90	-.40	-.35	-1.60	-2.10	-2.10	-.50	-.35	-.55	-.50	-.60	-.40	-2.60	-2.30	-1.50	-.80	-.40
	7-A	-.30	-.30	-.40	------	------	------	.00	-.25	+.10	------	------	-.20	------	------	------	-1.10	------
	7-B	-.40	-.40	-.60	-1.70	-.65	-2.20	-.50	-.40	-.40	.00	-.40	-.20	-1.30	-1.60	-1.30	-1.50	-.10
	7-C	-.90	-.60	-.70	-2.00	-1.10	-2.40	-.60	-.70	-.75	-.40	-.80	-.50	-1.60	-2.25	-1.20	-1.20	-.40
	7-D	-.80	-.35	-.40	-1.90	-1.85	-2.00	-.55	-.50	-.70	-.20	-.85	-.60	-1.40	-1.70	-1.10	-.90	-.35
	7-E	-1.10	-.50	-.40	-2.25	-2.55	-2.40	-.60	-.50	-.70	-.50	-1.00	-.70	-2.50	-3.80	-2.00	-.90	-.50
	8-A	-.45	-.30	-.35	-.20	-.20	-1.80	-.30	-.50	-.15	+.15	-.10	.00	-.85	-.80	-.60	-.60	-.40
	8-B	-.40	-.20	-.20	-.70	.00	-1.90	.00	-.30	+.10	+.30	-.05	+.10	-.65	-1.20	-.80	-.90	------
	8-C	-.30	-.30	-.35	-2.00	-.40	-2.40	.00	.00	-.10	.00	-.20	.00	-1.20	-1.45	-1.00	-1.00	-.10
	8-D	-.70	-.50	-.45	-1.90	-.80	-2.00	-.35	-.40	-.50	-.10	-.75	-.50	-.85	-1.35	-.70	-.60	-.50
	8-E	-1.50	-.60	-.45	-1.80	-1.80	-2.00	-.50	-.75	-.50	-.60	-1.20	-.90	-1.30	-2.70	-1.80	-.90	-.90

TABLE III—Continued

PRESSURE DISTRIBUTION ON THE TAIL SURFACES—Continued

[Pressures lb./sq. ft.]

Surface	Pad	Run No. 1	Run No. 2	Run No. 4	Run No. 5	Run No. 9a	Run No. 9b	Run No. 13	Run No. 17a	Run No. 17b	Run No. 21	Run No. 23	Run No. 25	Run No. 27a	Run No. 27b	Run No. 27c	Run No. 27d	Run No. 28
Lower fin and rudder, starboard side	1-A	+0.15	−2.90	+1.45	−0.20	------	------	−0.70	−3.30	−1.50	------	------	−1.00	−2.40	------	------	+2.00	------
	2-A	−.80	−.95	−1.30	−1.40	−0.20	−0.90	−.25	−.30	−.50	0.00	−0.35	−.10	−.40	−0.30	−0.50	−1.00	−0.45
	2-B	−.70	−1.45	−2.20	−2.10	−.20	−1.80	−.30	−.15	−.35	.00	−.40	.00	+.10	−.15	−1.05	−2.10	−.40
	2-C	−1.60	−2.30	−2.90	−2.40	−.90	−2.90	−1.00	−1.00	−1.10	−.30	−.80	−1.60	−.35	−.90	−2.05	−2.90	−1.00
	3-A	−.30	−.50	−.80	−.50	+.10	.00	------	−.20	+.30	−.10	.00	+.20	−.30	−.10	−.10	−.40	−.65
	3-B	−.50	−.65	−.95	−.85	−.05	−.40	------	−.20	−.40	+.10	------	.00	−.30	−.10	−.25	−.70	−.40
	3-C	−1.40	−1.65	−2.10	------	------	+2.00	------	−.90	−.80	------	------	------	------	------	------	−1.80	------
	4-A	------	−.55	−.65	−.15	−.15	------	−.25	------	−.20	−1.40	------	−.40	.00	------	−1.20	−.35	------
	4-B	−.50	−.55	−.80	−.50	------	+.25	−.05	−.20	−.10	+.10	−.20	.00	−.30	.00	+.25	−.20	−.30
	4-C	−.25	−1.10	−2.10	−1.40	+.40	−.85	+.15	.00	+.10	+.30	+.10	+.30	−.40	+.10	−.15	−1.10	−.40
	5-A	−.60	−.50	−.60	+.65	−.10	+.50	−.70	−.50	−.30	−.50	−.60	−.60	−.10	+.25	−.20	−.20	−.60
	5-B	−.60	−.35	−.55	+.60	+.20	+1.90	−.40	−.35	−.20	+.20	−.45	−.10	−.50	+.40	+.40	+.50	−.50
	5-C	−1.30	−1.25	−1.80	.00	+.50	+.90	−.50	−1.05	−.30	−.20	−.80	−.50	+.50	+1.05	−.40	−.50	−1.20
	5-D	−1.40	−1.20	−1.80	+1.50	+1.40	+2.80	+.45	−.15	+.30	+.20	−.60	−.20	+.50	+1.20	+2.50	+.50	−1.65
	5-E	−1.00	−1.00	−1.20	+1.00	------	+2.00	+.50	−.25	.00	+.20	−.50	.00	+.65	+2.60	+2.70	+.50	−1.50
	6-A	−.50	−1.10	−1.60	−.10	−1.40	−.75	−2.50	−1.80	−1.50	−1.20	−1.10	−1.70	−1.40	−1.10	−1.40	−1.40	−1.00
	6-B	−1.20	−.20	−.15	+1.10	+.85	+2.20	−.50	−.60	−.40	+.20	−.50	−.30	−.10	+1.10	+1.15	+1.30	−.90
	6-C	−1.40	−.90	−1.40	+.30	+1.20	+1.50	−.60	−.90	−.70	.00	−.90	−.60	.00	+1.30	+.90	+.20	−1.60
	6-D	−1.70	−.80	−1.25	−.20	−.20	+.70	−.70	−1.00	−.70	−.20	−1.10	−.80	−.40	+.50	.00	−.10	−1.50
	6-E	−1.20	−.70	−.80	−.10	+.65	+.75	.00	−.45	−.35	−.10	−.70	−.40	−.40	+.55	+.40	−.05	−1.40
	7-A	−.60	−.10	−.30	+.65	+.20	+.35	−.35	−.30	+.30	.00	−.20	−.10	+.15	−.30	+.10	+.20	−.40
	7-B	−1.00	−.30	−.50	+.50	+.25	+.90	−.15	−.30	.00	+.20	−.95	.00	−.30	.00	+.30	+.30	−.30
	7-C	−1.80	−1.30	−1.65	−.80	−.90	−.75	−1.00	−1.15	−1.30	−1.00	−1.40	−1.10	−1.20	−.50	−.70	−1.00	−1.50
	7-D	−1.70	−.85	−1.00	−.70	−.70	−.20	−1.00	−.90	−1.10	−.50	−1.20	−1.00	−.90	−.50	−.60	−.50	−1.60
	7-E	−.90	−.50	−.70	+.10	+.30	+.65	.00	−.40	.00	−.10	−.50	−.30	−.45	+.10	+.20	−.05	−1.00
	8-A	−.50	−1.00	−.70	+.40	−.20	+.50	.00	−1.30	−.80	−.95	−1.00	−1.20	+.20	−.35	+.20	−2.80	−.70
	8-B	−.50	−.40	−.60	−.10	−.10	------	.00	−.70	−.35	−.55	−1.25	−.50	−.20	−.50	−.90	−.50	−.50
	8-C	−.85	−.80	−1.10	−1.25	−.50	−.80	−.55	−.50	−.40	−.20	−.70	−.40	−1.10	−.85	−.70	−.80	−.50
	8-D	−.70	−.45	−.45	−.80	−.10	−.20	−.20	−.30	−.10	+.10	−.50	−.20	−.75	−.40	−.20	−.15	−.50
	8-E	−1.50	−.50	−.60	−.10	−.60	.00	−.30	−.75	−.30	−.50	−1.15	−.85	−.25	−.35	−.20	−.40	−1.35
Top fin, starboard side	1-A	−1.80	−2.70	−4.10	−5.90	−1.25	−4.40	−.20	−.50	−.80	−1.85	+1.15	−.70	+1.00	−.55	−2.90	−4.70	−1.90
	2-A	−1.20	−.80	−1.25	−1.40	−.70	−1.25	+1.35	.00	+.15	−.75	+.60	−.30	+.35	−.30	−1.00	−1.60	−.70
	2-B	−1.00	−.90	−1.40	−2.80	−.60	−1.20	+.85	−.30	+1.10	−1.60	−.70	−.30	------	+.20	−.95	−1.60	−1.00
	2-C	−1.50	−1.90	−2.60	------	−1.10	−2.80	.00	−.99	−.70	−1.30	−1.10	−.50	+.35	−.30	−2.00	−3.40	−1.30
	3-A	−.50	+.10	−.40	.00	−.50	−.60	+1.40	+.10	+1.45	−1.30	−.05	−.20	------	+.50	−.25	−.60	−.30
	3-B	−.70	−.40	−.80	−.80	−.65	−.60	+.20	+.10	−.60	−.80	−.60	−.40	−.10	−.50	−.90	−1.20	−.40
	3-C	------	−1.50	−2.90	−3.45	−1.10	−2.10	−.20	−.40	−.75	−1.60	−1.00	−.55	−.70	−.60	−1.35	−3.50	−1.10
	4-A	−.50	−.40	−.50	−.50	−.60	−.30	+.35	+.35	−.30	−1.25	−.50	.00	−.20	−.40	−.60	−.75	−.30
	4-B	−.85	−.05	−.45	−.40	−.70	−.60	−1.00	−.40	+1.10	−1.00	−1.50	−.30	+.35	.00	−.75	−1.00	−.40
	4-C	−1.20	−.10	−2.50	−1.85	−1.20	−3.30	−1.70	−.55	−1.50	−.60	−1.75	−1.00	−.60	−.50	−2.20	−3.00	−.40
	5-A	−.80	−.40	−.50	−.50	−.80	−.40	+.10	+.10	−.80	−2.00	−.80	−.30	−.60	−.50	−.90	−.60	−.50
	5-B	−1.10	−.90	−.90	−1.10	−1.00	−1.10	−.20	−.00	1.00	−1.70	−1.10	−.70	−.15	−.90	−1.10	−1.20	−.70
	5-C	−1.20	−1.40	−1.60	−1.40	−1.00	−2.30	.00	+.15	−.75	+.80	−1.10	−.40	−.40	−.50	−2.00	−2.10	−.90
Top fin, port side	1-A	−1.10	+.30	+1.20	+1.45	−1.10	+1.35	−.50	.00	+.65	------	−1.70	−1.00	−3.80	−1.95	+.20	+.80	−.70
	2-A	−.30	+.10	+.50	+.70	−.20	+.50	+.20	+.50	−.35	−1.10	−.65	−.20	−.95	−.55	+.20	.00	−.30
	2-B	−.40	+.15	+.70	+.95	−.25	+.85	+.10	+.20	−.20	−1.10	−.75	−.30	−1.20	−.60	+.40	+.55	−.20
	2-C	−.85	−.10	+.30	+.45	−.80	+.30	−.35	+.15	−.30	−1.70	−1.25	−.55	−2.30	−1.15	−.10	.00	−.50
	3-A	−.30	−.10	+.15	+1.10	−.20	+.20	+.20	+.50	−.50	−.90	−.60	.00	−.60	−.50	.00	−.20	−1.20
	3-B	−.60	−.30	.00	+.05	−.50	−.20	+.10	+.30	−.30	−1.25	−.80	−.20	−.80	−.50	−.20	−.40	−.50
	3-C	−1.00	−.65	−.70	−.70	−.75	−.70	−.20	+.10	−.65	−1.60	−1.20	−.40	−2.80	−1.00	−.40	−.90	−.70
	4-A	−.30	−.25	+.10	+.30	−.05	+.20	+.40	+.50	−.40	−1.00	−.50	.00	−.30	−.50	−.15	−.20	−.20
	4-B	−.40	−.20	+.20	+.30	−.10	+.20	+.55	+.65	+.20	−1.10	−.40	+.10	−.40	−.30	−.20	−.20	−.40
	4-C	−.40	.00	+.20	−.05	−.55	+.25	+.10	+.30	−1.00	−1.85	−1.35	−.50	−2.50	−.90	−.20	−.20	−.60
	5-A	−.90	−.60	−.40	−.45	−.60	−.60	+.20	+.35	−.20	−1.55	−.90	−.30	−.30	−1.00	−.60	−.85	−.80
	5-B	−.80	−.45	−.30	−.30	−.50	−.40	+.20	+.30	−.60	−1.40	−.85	−.20	−.55	−.70	−.35	−.70	−.80
	5-C	−1.10	−.35	−.50	−.50	−1.00	−.70	−.20	+.10	−1.30	−2.10	−1.50	−.70	−1.70	−1.25	−.60	−1.00	−.80

TABLE IV

LOADS ON TAIL SURFACES

Run No.	Condition	Air speed (M. P. H.)	Control angle (degrees)		Top fin				Bottom fin and rudder							
					Total load		Maximum local load		Total load		Load on fin		Load on rudder		Maximum local load	
			Rudder	Elevator	Lb.	C_{NF}	Lb. per sq. ft.	Sta.	Lb.	C_{NF}	Lb.	C_{NF}	Lb.	C_{NF}	Lb. per sq. ft.	Sta.
1	Horizontal flight	47.0	------	------	−59	−0.059	−0.9	2A	−5	−0.004	+22	+0.021	−27	−0.055	+1.3	1
2	Steady circle	36.5	8 R.	------	−101	−.163	−3.0	1	−204	−.225	−189	−.316	−15	−.054	−3.6	1
4	do	41.0	8 R.	------	−249	−.318	−5.3	1	−234	−.206	−207	−.276	−27	−.077	−2.9	2C
5	do	35.0	44 R.	------	*−311	−.554	*−7.3	1	+91	+.101	−60	−.106	+151	+.570	+6.6	5E–5D
9a	Start circle	45.5	44 R.	------	−74	−.077	−.7	4B–4C	+216	+.155	+102	+.110	+115	+.260	+5.2	5D–5E
9b	do	45.5	44 R.	------	−284	−.299	−5.7	1	+263	+.190	+13	+.014	*+250	+.565	+6.5	5D
13	Steady climb	42.0	------	19 U.	−10	−.011	−2.1	4B–4C	+36	+.031	------	------	------	------	−1.6	6A
17a	Start climb	48.0	------	19 U.	−82	−.078	−1.1	4B	−17	−.010	------	------	------	------	−2.4	1
17b	do	46.5	------	19 U.	+35	+.036	+2.0	3A	−78	+.054	------	------	------	------	+1.1	5D
21	Steady descent	46.0	------	21 D.	+20	+.022	+1.2	4C	+84	+.059	------	------	------	------	−1.2	6A
23	Horizontal flight (light)	43.0	------	------	+35	+.040	+2.8	1	+23	+.019	------	------	------	------	−1.2	8B
25	Rising flight (light)	47.0	------	------	+33	+.032	−.6	5B	+3	+.002	−13	−.013	+16	+.032	−1.3	6A
27a	Reversal first exposure	40.0	24L–18 R.	------	+207	+.280	+4.8	1	+226	+.207	+114	+.159	+111	+.328	+6.0	5D
27b	Reversal second exposure	40.5	24L–18 R.	------	+71	+.095	+1.4	1	*+352	+.316	+159	+.214	+193	+.552	+7.2	6E
27c	Reversal third exposure	41.5	24L–18 R.	------	−180	−.227	−3.2	1	+239	+.206	+97	+.125	+143	+.388	+5.9	5D–5E
27d	Reversal fourth exposure	42.0	24L–18 R.	------	−267	−.326	−5.6	1	+4	+.004	−94	−.120	+99	+.262	+3.6	6B
28	Bump	42.5	24L–18 R.	------	−18	−.021	−1.2	1	−92	−.076	−34	−.042	−58	−.151	−2.6	5D

Run No.	Condition	Port fin and elevator								Starboard fin and elevator							
		Total load		Load on fin		Load on elevator		Maximum local load		Total load		Load on fin		Load on elevator		Maximum local load	
		Lb.	C_{NF}	Lb.	C_{NF}	Lb.	C_{NF}	Lb. per sq. ft.	Sta.	Lb.	C_{NF}	Lb.	C_{NF}	Lb.	C_{NF}	Lb. per sq. ft.	Sta.
1	Horizontal flight	−83	−0.062	−31	−0.032	−51	−0.148	−2.1	6B	−101	−0.075	−90	−0.089	−10	−0.030	+2.0	8C
2	Steady circle	+27	+.032	+34	+.057	−7	−.033	+1.1	1	−18	−.023	−3	−.006	−15	−.079	−1.0	5D
4	do	+41	+.039	+41	+.055	0	0	+1.3	1	+6	+.005	------	------	------	------	+3.0	8D
5	do	+39	+.051	------	------	------	------	+1.3	1	−7	−.010	------	------	------	------	+1.3	8D
9a	Start circle	−49	−.040	------	------	------	------	−.9	5D	−27	−.021	------	------	------	------	−.9	2C
9b	do	−60	−.047	------	------	------	------	+1.0	5D	−2	−.002	------	------	------	------	−1.3	8D
13	Steady climb	+69	+.064	+104	+.133	−34	−.131	+3.7	1	+95	+.086	+125	+.158	−30	−.115	+3.3	1
17a	Start climb	+80	+.058	*+132	+.126	−52	−.150	+2.7	2C	+24	+.017	+69	+.065	−45	−.129	+3.8	1
17b	do	+127	+.097	+24	+.024	*+102	+.306	+3.9	5D	+116	+.087	+20	+.020	*+96	+.294	+4.7	5D
21	Steady descent	−73	−.057	−125	−.132	+52	+.165	−4.3	1	−147	−.113	*−200	−.210	+54	+.170	*−5.3	1
23	Horizontal flight (light)	−121	−.108	−86	−.102	−35	−.128	−1.9	5D	−108	−.095	−81	−.098	−26	−.095	−1.4	1
25	Rising flight (light)	−40	−.030	−35	−.034	−6	−.018	−.9	6B	−12	−.009	−5	−.005	−7	−.020	−.8	8B
27a	Reversal first exposure	−89	−.090	------	------	------	------	−1.3	2B–2C	−30	−.032	------	------	------	------	−2.3	8D
27b	Reversal second exposure	−46	−.045	------	------	------	------	−1.0	1	+4	+.005	------	------	------	------	+2.1	8B
27c	Reversal third exposure	−82	−.077	------	------	------	------	−1.5	1	+13	+.011	------	------	------	------	+2.3	8B
27d	Reversal fourth exposure	+42	+.040	------	------	------	------	+1.0	4C	+106	+.097	------	------	------	------	+2.4	5D
28	Bump	*−181	−.162	−87	−.105	−94	−.329	*−5.7	5D	*−152	−.136	−114	−.129	−39	−.142	−3.5	5D

+Indicates load acting from bottom to top on horizontal surfaces.
+Indicates load acting from starboard to port on vertical surfaces.
* Indicates maximum load encountered.
Areas: Fixed surfaces, 180 sq. ft. each; elevators, 60 sq. ft. each; rudder, 85 sq. ft.

$C_{NF}=\frac{p}{\frac{1}{2}\rho V^2}$

C_{NF} = Absolute coefficient.
p = Pressure per unit area.
ρ = Air density.
V = True air speed.

TABLE V

PRESSURE DISTRIBUTION TESTS ON ENVELOPE

Table of data

	Run No. 1	Run No. 2	Run No. 4	Run No. 5	Run No. 9a	Run No. 9b	Run No. 13	Run No. 17a	Run No. 17b
Wind direction	Variable.	Variable.	Variable.	Variable.	ENE.	ENE.	Variable.	Variable.	Variable.
Wind velocity (M. P. H.)	12	6	6	12	9	9	6	12	12
Air in balloonets (cu. ft.)	None.	None.	None.	None.	2, 000	2, 000	None.	None.	None.
Static condition (lb. light)	75	25	Equilib.	75	Equilib.	Equilib.	Equilib.	75	75
R. P. M. starboard	1, 250	1, 000	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250
R. P. M. port	1, 250	1, 000	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250
Gas pressure (inches of water)	1½	1⅛	1⅝	1½	1½	1½	1⅜–2¼	1⅜–2	1⅜–2
Rudder angle (degrees)	0	5 R.	5 R.	18 R.	18 R.	18 R.	0	0	0
Elevator angle (degrees)	0	0	0	0	0	0	12 U.	12 U.	12 U.
Air speed (knots)	45	33	39	35	45	45	39	45	45
Compass course (degrees)	210	Various.	Various.	Various.	Various.	Various.	25	210	210
Inclination (degrees)	0	0	0	0	----	----	12.5 U.	13 U.	13 U.
Barometric pressure (at manometer)	29. 93	30. 12	30. 04	29. 94	30. 15	30. 15	30. 16	29. 91	29. 82
Temperature (°F.)	63	77	77	64	73	73	77	64	64
Air density	0. 00236	0. 00231	0. 00230	0. 00235	0. 00233	0. 00233	0. 00231	0. 00235	0. 00234
Corrected rudder angle (degrees)	0	8 R.	8 R.	44 R.	44 R.	44 R.	0	0	0
Corrected elevator angle (degrees)	0	0	0	0	0	0	19 U.	19 U.	19 U.
Corrected air speed (M. P. H.) (N. A. C. A. recording instrument)	43. 0	35. 0	37. 5	32. 5	41. 5	42. 0	40. 0	45. 0	45
Angle of yaw (degrees)	2.0 L.	6 R.	5 R.	6.5 R.	7.8 R.	7.8 R.	2.0 L.	2.5 R.	2.5 R.
Fore and aft inclination (degrees)	----	−5. 4	+1. 2	----	+1. 1	−0. 2	+10. 5	+5. 0	+5. 0
Inclination of flight path (degrees)	----	−2. 8	−0. 7	−2. 8	+0. 5	+0. 5	+8. 0	+2. 3	+2. 3
Angle of pitch (degrees)	----	−2. 6	+0. 5	----	+0. 6	−0. 7	+2. 5	+2. 7	+2. 7
Time of complete turn (minutes)	----	2. 32	1. 42	1. 22	----	----	----	----	----

	Run No. 21	Run No. 23	Run No. 25	Run No. 27a	Run No. 27b	Run No. 27c	Run No. 27d	Run No. 28
Wind direction	ENE.	NE.	Variable.	Variable.	Variable.	Variable.	Variable.	Variable.
Wind velocity (M. P. H.)	9	13	12	12	12	12	12	12
Air in balloonets (cu. ft.)	2, 000	None.	None.	None.	None.	None.	None.	None.
Static condition (lb. light)	Equilib.	525	525	75	75	75	75	525
R. P. M. starboard	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250
R. P. M. port	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250	1, 250
Gas pressure (inches of water)	1⅞–1¼	1½	1⅝–2	1½	1½	1½	1½	1⅜–2⅛
Rudder angle (degrees)	0	0	0	10 L–10 R.	10 L–10 R.	10 L–10 R.	10 L–10 R.	10 L–14 R.
Elevator angle (degrees)	12 D.	5½ D.	3 D.	0	0	0	0	4 U–16 D.
Air speed (knots)	40	39	45	38½	38½	38½	38½	43
Compass course (degrees)	67	45	210	Various.	Various.	Various.	Various.	210
Inclination (degrees)	O–15	3 D.	0	0	0	0	0	3 U–18 D.
Barometric pressure (at manometer)	30. 02	30. 03	29. 82	30. 14	30. 14	30. 14	30. 14	29. 91
Temperature (°F.)	73	73	63	74	74	74	74	63
Air density	0. 00232	0. 00232	0. 00235	0. 00233	0. 00233	0. 00233	0. 00233	0. 00235
Corrected rudder angle (degrees)	0	0	0	24 L–18 R.	24 L–18 R.	24L–18 R.	24 L–18 R.	24 L–28 R.
Corrected elevator angle (degrees)	18 D.	8 D.	4 D.	0	0	0	0	7 U–25 D.
Corrected air speed (M. P. H.) (N. A. C. A. recording instrument)	43	46	45	38	38. 5	40. 0	42. 0	45. 0
Angle of yaw (degrees)	2.7 L.	2.6 R.	0.5 L.	0–7 R.	0–7 R.	0–7 R.	0–7 R.	----
Fore and aft inclination (degrees)	−5. 0	----	0	----	----	----	----	−. 4
Inclination of flight path (degrees)	−2. 6	+1. 4	+2. 5	−0. 6	−0. 6	−0. 6	−0. 7	0
Angle of pitch (degrees)	−2. 4	----	−2. 5	----	----	----	----	−. 4
Time of complete turn (minutes)	----	----	----	----	----	----	----	----

TABLE VI

PRESSURE DISTRIBUTION ON THE ENVELOPE

Pressure lb./sq. ft.

Station No.	Distance to nose, ft.	Diameter, ft.	Pad	Run No. 1	Run No. 2	Run No. 4	Run No. 5	Run No. 9a	Run No. 9b	Run No. 13	Run No. 17a	Run No. 17b	Run No. 21	Run No. 23	Run No. 25	Run No. 27a	Run No. 27b	Run No. 27c	Run No. 27d	Run No. 28
3------	2.7	8.0	A	+2.90	+2.00	+3.00	+2.00	+3.15	+2.90	+3.40	+3.25	+3.50	+2.90	+3.35	+3.15	+2.50	+2.50	+2.50	+3.00	+3.40
			B	+2.70	+2.00	+3.05	+2.40	+3.20	+3.40	+3.20	+3.40	+3.35	+2.65	+3.40	+3.20	+2.65	+2.40	+2.70	+3.20	+3.45
			C	+2.35	+2.00	+3.00	+2.10	+3.35	+3.45	+2.85	+3.50	+3.60	+3.30	+3.80	+3.40	+2.60	+2.70	+2.85	+3.10	+3.45
			D	+2.35	+2.20	+3.10	+2.10	+2.95	+3.50	+3.40	+3.25	+3.40	+3.10	+3.75	+3.50	+2.60	+2.40	+2.60	+2.90	+3.50
			E	+2.30	+2.05	+3.15	+2.60	+3.45	+3.60	+2.95	+3.20	+3.60	+3.50	+4.10	+3.40	+2.40	+2.70	+2.10	+3.10	+3.45
			F	+2.35	+2.35	+3.30	+2.50	+3.35	+3.35	+3.10	+3.05	+3.45	+3.30	+4.20	+3.40	+2.55	+2.30	+2.30	+2.60	+3.45
			G	+2.60	+2.05	+3.00	+2.20	+3.25	+3.25	+2.95	+3.10	+3.60	+3.20	+3.70	+3.60	+3.15	+2.60	+3.10	+3.30	+3.45
			H	+2.60	+2.00	+3.10	+2.40	+3.20	+3.10	+3.20	+3.35	+3.70	+2.90	+3.60	+3.30	+2.70	+3.00	+2.70	+3.30	+3.45
4------	4.7	12.8	A	+1.70	+1.60	+2.60	+2.10	+2.65	+2.50	+2.60	+2.50	+2.65	+2.00	+2.50	+2.60	+1.85	+2.00	+2.10	+2.40	+2.60
			B	+1.70	+1.55	+2.40	+2.20	+2.45	+2.65	+2.45	+2.60	+2.40	+2.00	+2.55	+2.50	+2.05	+2.00	+2.25	+2.45	+2.45
			C	+1.70	+1.60	+2.40	+1.70	+2.65	+2.80	+2.40	+2.85	+2.85	+2.50	+3.05	+2.75	+2.05	+2.20	+2.30	+2.65	+2.60
			D	+1.60	+1.75	+2.60	+1.80	+2.65	+3.00	+2.80	+2.60	+2.30	+2.30	+3.30	+2.90	+2.10	+1.80	+1.70	+2.25	+2.60
			E	+1.55	+1.95	+2.60	+2.50	+2.70	+2.90	+2.55	+2.55	+2.90	+3.05	+3.30	+3.00	+1.80	+2.35	+1.60	+2.40	+2.75
			F	+2.00	+1.80	+2.60	+2.30	+2.45	+2.55	+2.40	+2.70	+3.00	+2.50	+3.10	+3.00	+2.35	+2.00	+1.85	+2.25	+3.10
			G	+2.00	+1.30	+2.55	+2.00	+2.35	+2.35	+2.30	+2.20	+2.70	+2.20	+2.80	+2.70	+2.40	+1.90	+2.20	+2.40	+2.80
			H	+2.05	+1.85	+2.55	+2.20	+2.40	+2.65	+2.65	+2.60	+2.85	+1.80	+2.70	+2.70	+2.20	+2.30	+2.00	+2.60	+2.85
5------	6.5	16.5	A	+1.25	+1.15	+1.75	+2.10	+1.80	+1.90	+2.35	+1.90	+2.00	+1.00	+1.80	+2.00	+1.30	+1.40	+1.50	+2.00	+1.90
			B	+1.05	+1.15	+1.75	+2.00	+1.85	+2.00	+1.90	+1.90	+1.85	+1.20	+1.70	+1.80	+1.45	+1.50	+1.60	+1.95	+1.80
			C	+1.65	+1.15	+1.55	+1.50	+2.00	+2.00	+1.80	+2.15	+2.10	+1.80	+2.10	+1.80	+1.75	+1.80	+1.70	+2.00	+2.05
			D	+.80	+1.35	+2.10	+1.50	+2.00	+2.30	+1.95	+1.55	+1.60	+2.10	+2.55	+2.25	+1.50	+1.30	+0.60	+1.80	+1.75
			E	+1.10	+1.45	+2.20	+2.50	+2.15	+2.30	+1.95	+1.90	+2.10	+2.40	+2.65	+2.40	+1.25	+1.85	+1.20	+2.00	+1.90
			F	+1.70	+1.45	+2.15	+2.30	+1.90	+2.05	+2.00	+2.05	+2.55	+1.80	+2.50	+2.40	+2.00	+1.60	+1.50	+1.75	+2.60
			G	+1.30	+1.25	+1.95	+1.90	+1.80	+1.80	+1.80	+1.65	+2.10	+1.60	+2.15	+1.85	+1.90	+1.40	+1.30	+1.70	+2.15
			H	+1.10	+1.10	+1.65	+2.10	+1.65	+1.70	+1.85	+1.55	+1.85	+1.15	+1.80	+1.75	+1.50	+1.20	+1.20	+1.60	+1.85
7------	11.0	23.5	A	+.20	+.40	+.95	+2.10	+.75	+ 80	+1.05	+.65	+.75	+.15	+.50	+.80	+.60	+.50	+.50	+.85	+.65
			B	+.10	+.35	+.80	+1.65	+.70	+.75	+.90	+.65	+.70	+.75	+.50	+.70	+.50	+.70	+.50	+ 75	+.55
			C	+.10	+.30	+.90	+1.70	+.80	+.80	+.65	+.80	+.80	+.70	+.80	+ 80	+.70	+.90	+.65	+1.10	+.70
			D	−.75	+.45	+1.10	+.75	+.50	+.85	+.80	+.50	+.80	+.30	+.85	+1.00	+.60	+.60	.00	+.105	+.65
			E	+.80	+.75	+1.20	+2.10	+1.00	+1.05	+.85	+1.05	+1.15	+.90	+1.45	+1.35	+.25	+.90	+.60	+.90	+.80
			F	+.90	+.40	+.95	+2.30	+.50	+.50	+.65	+.60	+.75	+.45	+.80	+.85	+.75	+.45	+.35	+.45	+.75
			G	+.40	+.45	+1.00	+1.80	+.65	+.60	+.70	+.65	+.80	+.35	+.65	+.90	+.70	+.50	+.30	+.60	+.80
			H	−1.05	+.45	+1.00	+1.50	+.65	+.70	+1.00	+.55	+.80	+.25	+.60	+.65	+.75	+.40	+.45	+ 50	+.65
10-----	18.3	31.2	A	−.75	−1.70	−.50	−.70	−.60	−.65	−.70	−.60	−1.00	−1.10	−.90	− 90	−.45	−.60	−.40	−1.10	−.95
			B	−1.00	−1.50	−.40	−.40	−.50	−.70	−.40	−.60	−1.15	−1.30	−.80	−1.00	−.50	−.60	−.50	−1.20	−1.10
			C	−1.15	−.95	−.40	−.50	−.50	−.60	−.50	−.60	−.60	−1.00	−.70	−1.10	−.50	−.50	−.40	−.85	−.90
			D	−.65	−.70	−.30	−.40	−.70	−.65	−.35	−.70	−.75	−1.00	−.55	−.50	−.35	−.65	−.55	−.70	−.75
			E	−.65	−.75	−.45	−.70	−.90	−.70	−.70	−1.05	−1.10	−.70	−.80	−.90	−.65	−1.10	−1.00	−1.10	−1.10
			F	−.50	−.75	−.25	−.70	−.60	−.75	−.60	−.70	−1.10	−1.00	−1.00	−.90	−.65	−.80	−1.10	−1.25	−1.00
			G	−1.10	−.90	−.60	−1.00	−1.20	−1.10	−1.00	−1.10	−1.45	−1.25	−1.20	−1.10	−.55	−.70	−1.40	i.25	−1.30
			H	−1.25	−1.50	−.40	−.70	−.80	−.85	−.70	−.60	−.75	−.90	−1.10	−.80	−.50	−.75	−.75	−1.00	−.90
12-----	23.5	34.7	A	−1.00	−.55	−.30	+.80	−.75	−.70	−.25	−.75	−1.00	−1.50	−1.00	−.60	−.45	−.50	−.60	−.55	−1.00
			B	−1.15	−.80	−.45	+.80	− 85	−.75	−.60	−.80	−1.05	−1.40	−1.05	−.90	−.55	−.65	−.70	−.55	−1.10
			C	−1.40	−.60	−.45	+1.00	−.80	−.85	−.50	−.95	−.90	−1.30	−1.00	−1.00	−.65	−.85	−.60	−.70	−1.00
			D	− .50	−.65	−.35	+1.10	−.80	−.75	−.80	−.35	−.90	−1.00	−.80	−.40	−.10	−.40	−.50	−.30	−.30
			E	− .90	−.55	−.15	+1.00	−.80	−.70	−.70	−.60	−.90	−1.00	−.50	−.35	−.15	−.50	−.70	−.50	− 65
			F	−1.00	−.80	−.45	+.70	−.90	−1.15	−.90	−.90	−1.10	−1.20	−1.10	−.80	−.45	−.85	−.90	−1.00	−1.00
			G	−1.20	−.75	−.45	+.70	−1.10	−1.00	−.90	−1.20	−1.40	−1.60	−1.20	−1.00	−.75	−.85	−1.00	−.95	−1.60
			H	−1.30	−.70	−.35	+.60	−1.10	−1.00	−.80	−.95	−1.00	−1.30	−1.05	− 80	−.60	−.85	−1.10	−.90	−1.00
13½---	27.3	36.5	A	−1.00	−.55	−.25	+.85	−.85	−.80	.00	−.70	−.80	−1.40	−.95	−.60	−.30	−.60	−.70	−.50	−.90
			B	−1.20	−.70	−.35	+.90	−.90	−.70	−.60	−.80	−1.00	−1.30	−.95	−.80	−.25	−.60	−.80	−.60	−1.05
			C	−1.70	−1.05	−.50	+.90	−.85	−.90	−.40	−1.05	−.90	−1.60	−1.20	−1.00	−.65	−.95	−.90	−.65	−1.10
			D	−.40	−.75	−.50	+1.50	−1.00	−.95	−.75	−.50	−.90	−1.10	−.95	−.40	−.50	−.30	−.60	−.60	−.50
			E	−1.00	−.75	−.50	+1.00	−1.00	−1.10	−.95	−.65	−.90	−1.30	−.95	−.40	−.40	−.60	−.85	−.60	−.70
			F	−1.15	−.80	−.45	+.70	−1.00	−1.30	−.80	−1.00	−1.10	−1.35	−1.10	−.80	−.30	−.75	−.85	−.80	−1.05
			G	−1.30	−.75	−.45	+.60	−1.15	−1.25	−.90	−1.00	−1.20	−1.80	−1.20	−.90	−.40	−.90	−.85	−.80	−1.10
			H	−1.10	−.75	−.40	+.70	−.90	−1.00	−.70	−.90	−1.05	−1.35	−1.05	−.80	−.30	−.60	−.90	−.60	−1.00
17-----	37.4	39.9	A	−1.00	−.80	−.45	−.40	−.90	−1.10	−.80	−.70	−1.00	−1.00	−1.00	−.80	−.30	−.70	−1.00	−.65	−1.05
			B	−1.10	−.80	−.45	−.40	−1.00	−.90	−.80	−.75	−.95	−1.00	−1.00	−.75	−.25	−.65	−1.00	−.70	−1.00
			C	−1.40	−1.05	−.75	−.35	−1.25	−1.35	−1.00	−1.10	−1.30	−1.30	−1.30	−1.10	−.55	−.90	−.95	−.90	−1.05
			D	− .50	−1.00	−.60	−.35	−.90	−.90	−.65	−.80	−1.00	−.80	−1.00	−.50	−.40	−.50	−.75	−.75	−.90
			E	− .90	−.75	−.40	−.75	−1.40	−1.10	−.80	−1.20	−1.45	−1.95	−1.35	−1.15	−.80	−.90	−.80	−1.10	−.90
			F	−1.00	−.90	−.60	−.50	−1.15	−1.30	−.55	−.90	−1.00	−1.70	−1.10	−.90	−.45	−.55	−1.00	−.55	−1.10
			G	−1.05	−.95	−.70	−.40	−1.25	−1.15	−1.10	−1.00	−1.15	−1.55	−1.30	−1.10	−.50	−1.05	−.90	−.85	−1.20
			H	−1.00	−.90	−.65	−.40	−1.10	−1.10	−1.00	−.65	−1.00	−1.10	−1.10	−.70	−.25	−.50	−.80	−.55	−.80

TABLE VI—Continued

PRESSURE DISTRIBUTION ON THE ENVELOPE—Continued

Pressure lb./sq. ft.

Station No.	Distance to nose, ft.	Diameter, ft.	Pad	Run No. 1	Run No. 2	Run No. 4	Run No. 5	Run No. 9a	Run No. 9b	Run No. 13	Run No. 17a	Run No. 17b	Run No. 21	Run No. 23	Run No. 25	Run No. 27a	Run No. 27b	Run No. 27c	Run No. 27d	Run No. 28
17	37.4	39.9	A′	−0.75	−0.55	−0.40	−0.40	−0.80	−0.90	−0.70	−0.65	−0.80	−0.90	−0.90	−0.80	−0.15	−0.40	−0.75	−0.75	−0.95
			B′	−.70	−.75	−.60	−.35	−1.00	−1.00	−.65	−.80	−1.10	−1.15	−1.00	−.80	−.20	−.50	−.90	−.90	−.90
			C′	−.70	−.75	−.50	−.25	−.85	−1.10	−.90	−.85	−1.20	−1.05	−1.00	−.80	−.30	−.50	−.90	−.90	−.95
			D′	−.60	−.83	−.60	−.40	−1.00	−1.20	−.90	−1.05	−1.20	−1.05	−.95	−.80	−.20	−.55	−.70	−.95	−.90
			E′	−.70	−.80	−.65	−.50	−1.30	−1.10	−.65	−1.15	−1.30	−1.85	−1.10	−1.10	−.70	−.80	−.95	−.90	−.75
			F′	−1.00	−.60	−.45	−1.20	−1.30	−1.40	−.60	−.95	−1.10	−1.70	−1.25	−1.15	−.50	−1.00	−.90	−.70	−1.30
			G′	−.65	−.85	−.70	−.45	−1.10	−1.05	−1.20	−.95	−1.25	−1.30	−1.10	−.95	−.30	−.60	−1.00	−.85	−1.15
			H′	−.90	−.50	−.40	−.40	−.90	−.75	−.65	−.60	−.95	−1.20	−.80	−.85	.00	−.50	−.65	−.55	−.80
20	46.3	41.3	A	−.80	−.60	−.25	−.50	−.75	−.65	−.70	−.65	−1.00	−.70	−.80	−.70	−.40	−.65	−.80	−.80	−.95
			B	−.85	−.60	−.45	−.60	−.80	−.90	−.90	−.80	−1.20	−.95	−.85	−.95	−.40	−.80	−.95	−.85	−1.05
			C	−.95	−.60	−.40	−.50	−.60	−1.10	−.90	−.70	−1.00	−1.00	−.90	−1.00	−.90	−.60	−.80	−.70	−1.00
			D	−.55	−.45	−.15	−.30	−.30	−.40	−.20	−.40	−.65	−.45	−.25	−.25	−.20	−.10	−.45	−.55	−.40
			E	−.80	−.75	−.50	−.40	−.65	−.70	−.75	−.65	−.85	−.60	−.80	−.45	−.30	−.60	−.70	−.70	−.65
			F	−.75	−.70	−.50	−.50	−.90	−1.00	−1.00	−.90	−1.00	−1.10	−.90	−.75	−.50	−.70	−.80	−.55	−1.00
			G	−.75	−.60	−.35	−.50	−.60	−.70	−.90	−.40	−1.00	−.90	−.70	−.75	−.20	−.40	−.75	−.75	−.75
			H	−.75	−.55	−.35	−.40	−.65	−1.00	−.90	−.60	−.90	−1.00	−.85	−.60	−.30	−.45	−.65	−.55	−.70
26	63.7	42.0	A	−.70	−.75	−.15	−.20	−.55	−.15	−.20	−.35	−.60	−.65	−.30	−.20	−.25	−.40	−.55	−.30	−.40
			B	−.80	−.70	−.15	−.25	−.50	−.35	−.40	−.50	−.60	−.55	−.50	−.50	.00	−.30	−.55	−.50	−.60
			C	+.15	−.20	+.25	+.35	+.20	+.30	.00	+.15	+.15	−.85	+.30	+.20	+.35	+.25	.00	+.20	−.50
			D	−.40	−.60	+.15	−.30	−.40	−.40	−.10	−.40	−.40	−.50	−.40	−.15	−.20	−.30	−.50	−.40	−.35
			E	−.60	−.95	−.15	−.40	−.50	−.35	−.10	−.40	−.75	−1.00	−.55	−.30	−.20	−.20	−.60	−.35	−.45
			F	−.65	−.90	−.05	−.35	−.55	−.10	−.20	−.50	−.75	−.95	−.60	−.45	−.10	−.10	−.60	−.20	−.65
			G	−.40	−.45	+.05	−.30	−.60	−.10	−.30	−.20	−.60	−.50	−.30	−.20	+.10	+.05	−.30	−.10	−.40
			H	−.60	−.75	−.20	−.65	−.70	−.40	−.60	−.45	−.70	−.90	−.50	−.40	−.30	−.35	−.50	−.40	−.50
40	104.2	39.7	A	−.40	−.30	+.05	−.45	+.10	+.15	−.10	+.10	−.15	+.05	+.10	−.05	+.15	+.10	−.20	−.05	−.05
			B	−.55	−.25	+.15	+.05	−.30	−.15	−.10	−.20	−.20	−.30	−.15	−.10	.00	−.10	−.40	−.10	−.25
			C	−.60	−.35	+.15	−.10	−.25	.00	−.15	−.30	−.20	−.50	−.35	−.10	.00	−.30	−.45	−.35	−.30
			D	−.60	−.40	+.15	−.40	−.30	.00	.00	−.25	−.20	−.70	−.30	−.15	−.15	−.25	−.40	−.25	−.35
			E	−.50	−.40	.00	−.60	−.30	−.35	−.10	−.20	−.60	−.60	−.30	−.40	−.10	−.20	−.50	−.30	−.30
			F	−.60	−.40	+.05	−.25	−.10	−.20	−.10	−.15	−.60	−.25	−.30	−.20	.00	−.10	−.30	+.05	−.10
			G	−.85	−.25	+.05	−.20	−.20	−.20	−.20	−.10	−.10	−.75	−.20	−.35	.00	−.05	−.45	+.05	−.45
			H	−.55	−.40	+.05	−.40	−.25	−.15	−.25	−.10	−.30	−.40	−.20	−.25	+.20	+.10	−.40	−.15	−.20
49	130.0	35.7	A	−.50	−.20	+.15	−.30	−.10	.00	.00	+.10	.00	−.10	+.10	−.05	+.10	+.10	−.25	.00	+.05
			B	−.45	−.15	+.20	+.10	.00	+.10	−.10	.00	.00	−.15	.00	−.05	.00	.00	−.25	.00	.00
			C	−.45	−.15	+.40	+.05	−.05	+.40	−.05	−.05	.00	−.25	.00	.00	.00	−.05	−.15	−.05	.00
			D	−.60	−.35	+.15	−.30	−.25	.00	−.10	−.20	−.15	−.60	−.30	−.30	−.20	−.20	−.30	−.20	−.30
			E	−.50	−.40	−.05	−.85	−.30	−.40	+.20	−.05	−.40	−.80	−.25	−.30	−.10	−.10	−.50	−.20	−.25
			F	−.50	−.40	−.35	−.45	−.25	−.50	−.40	−.20	−.45	−.70	−.25	−.50	−.05	−.30	−.50	−.30	−.30
			G	−.45	−.40	+.05	−.30	.00	−.05	−.05	.00	−.25	−.55	−.05	−.20	+.35	+.15	−.25	−.10	−.20
			H	−.40	−.25	+.05	−.30	+.10	+.05	.00	+.20	−.10	−.10	+.10	.00	+.30	+.20	−.15	.00	.00
49	130.0	35.7	A′	−.40	−.20	+.05	−.25	+.15	.00	−.20	+.05	−.30	.00	+.25	−.20	+.10	−.20	−.30	−.20	−.15
			B′	−.45	−.20	+.15	.00	.00	.00	−.10	−.20	−.05	−.15	.00	−.20	−.15	.00	−.60	−.40	.00
			C′	−.65	−.35	−.05	−.20	−.65	−.25	−.25	−.60	−.65	−.55	−.40	−.50	−.50	−.70	−.75	−.60	−.30
			D′	−.45	−.30	−.10	−.40	−.20	.00	+.30	−.15	+.10	−.60	−.15	−.15	−.30	−.20	−.20	−.15	.00
			E′	−.25	−.45	−.65	−.85	−.40	−.60	−.50	−.25	−.70	−.80	−.35	−.40	−.25	−.30	−.70	−.40	−.30
			F′	−.15	−.40	−.30	−.40	−.50	−.40	−.35	.00	−.45	−.80	−.10	−.30	+.25	+.20	−.50	−.10	−.30
			G′	−.20	−.20	+.05	−.30	−.20	.00	−.10	+.20	−.10	−.40	+.20	−.10	+.30	+.20	−.20	.00	.00
			H′	−.30	−.20	−.15	−.40	−.15	−.20	−.30	+.15	−.15	−.10	+.15	−.15	.00	+.15	−.60	.00	−.10
53	141.2	33.0	A	−.25	−.10	+.15	−.30	+.15	+.20	+.20	+.30	+.15	+.15	+.25	+.05	+.20	+.15	−.05	+.05	+.40
			B	−.25	−.15	+.20	−.10	+.15	+.30	+.20	+.35	+.25	.00	+.10	+.15	+.15	+.20	.00	+.20	+.30
			C	−.50	−.15	+.25	−.10	.00	+.40	+.10	−.10	−.10	−.60	−.50	−.15	+.10	.00	−.35	−.15	−.20
			D	−.90	−.50	.00	−.60	−.20	.00	−.20	.00	.00	−.60	−.30	−.30	−.25	.00	−.30	−.20	−.20
			E	−.70	−.55	−.25	−.90	−.15	−.15	+.30	.00	+.15	−.80	−.30	.00	−.25	−.10	−.10	−.10	.00
			F	−.40	−.45	−.20	−.80	−.20	−.45	−.40	+.20	−.30	−.85	−.25	−.40	−.15	−.50	−.40	−.35	+.30
			G	−.25	−.20	.00	−.50	−.10	−.15	−.35	+.25	.00	−1.00	.00	.00	+.25	+.30	.00	+.10	+.20
			H	−.30	−.15	+.15	−.45	+.05	−.10	−.10	+.30	.00	−.10	.00	−.05	+.15	+.20	−.20	.00	+.10
57	152.5	30.0	A_S	−.60	−.45	−1.35	−1.00	−.15	−1.15	.00	+.15	−.15	−.30	−.10	−.20	+.55	+.30	−.30	−.55	.00
			A_P	.00	+.25	+.65	+.70	−.10	+.70	−.50	.00	−.15	−.30	.00	−.10	−1.05	−.60	−.35	+.45	.00
			B	−.35	−.35	−.05	−.40	−.10	−.10	−.10	+.10	.00	−.35	−.05	−.10	+.15	.00	−.25	.00	+.05
			C_L	−.80	−.35	+.05	−.15	−.60	−.10	−.05	−.05	−.15	−1.30	−.10	−.55	−.15	−.20	−.55	−.35	−.45
			C_U	−1.05	−.15	.00	.00	−.35	−.25	−1.00	−1.30	−.95	.00	−.10	−.60	−1.05	−1.00	−1.60	−.50	.00
			D	−.70	−.40	+.05	−.50	−.20	−.20	−.15	−.10	+.15	−.60	−.20	−.20	−.30	−.20	−.20	−.20	−.10
			E_S	−.55	−.95	−1.30	−2.55	−.10	−1.15	+.10	+.30	+.15	−.55	−.15	−.10	+.75	+.40	−.35	−.75	.00
			E_P	−.25	+.25	+1.20	+.90	−.40	+.75	+.40	−.15	.00	−1.25	−.20	−.20	−1.35	−.85	−.30	+.65	+.10
			F	−.35	−.55	−.30	−.75	−.10	−.40	−.20	.00	−.30	−.55	−.20	−.30	.00	+.05	−.45	−.10	−.10
			G_L	−.15	−.25	+.20	−.40	−.30	−.30	−.40	+.45	+.20	−1.00	−.10	−.40	+.40	+.05	−.35	.00	−.40
			G_U	−.75	−.40	−.40	−.55	−.50	−.50	−.90	−.40	−1.15	−.30	−.10	−.40	−.20	−.30	−.30	.00	.00
			H	−.20	.00	+.35	−.30	.00	.00	−.15	+.25	+.10	−.20	+.10	−.10	+.25	+.15	−.15	+.20	+.15

TABLE VI—Continued

PRESSURE DISTRIBUTION ON THE ENVELOPE—Continued

Pressure lb./sq. ft.

Station No.	Distance to nose, ft.	Diameter, ft.	Pad	Run No. 1	Run No. 2	Run No. 4	Run No. 5	Run No. 9a	Run No. 9b	Run No. 13	Run No. 17a	Run No. 17b	Run No. 21	Run No. 23	Run No. 25	Run No. 27a	Run No. 27b	Run No. 27c	Run No. 27d	Run No. 28
59-----	158.3	28.3	A_S	−0.55	−0.55	−0.80	−0.85	−0.15	−0.50	−0.35	+0.10	−0.30	−0.30	−0.15	−0.25	+0.35	+0.10	−0.15	−0.20	+0.15
			A_P	+.20	+.20	+.50	+.50	−.20	+.40	−.30	+.10	+.05	−.30	.00	+.10	−.50	−.20	−.40	+.20	+.15
			B	−.40	−.45	−.10	−.30	−.15	+.05	−.40	.00	.00	−.40	−.25	−.20	.00	.00	−.30	.00	+.10
			C_L	−.65	−.40	−.05	−.40	−.25	+.35	−.40	−.30	−.35	−.60	−.05	−.50	−.70	−.35	−.40	−.40	−.70
			C_U	−.60	+.15	+.40	+.25	−.20	+.30	−.10	−.30	−.25	.00	−.15	−.10	−.50	−.50	−.30	−.10	+.25
			D	−.60	−.65	.00	−.50	−.30	−.20	−.30	−.55	.00	−.55	−.10	−.40	−.35	−.30	−.45	−.40	−.25
			E_S	−.70	−.60	−.55	−1.60	+.05	−.35	+.20	−.25	−.15	−.70	−.40	+.10	−.35	−.30	−.10	−.25	−.30
			E_P	+.05	+.15	+.35	+.10	−.35	+.20	−.25	+.05	−.40	−.75	+.10	−.35	−.30	−.40	−.50	.00	−.30
			F	−.30	−.45	.00	−.50	−.20	−.15	−.30	+.20	−.15	−.55	−.15	−.25	+.05	+.10	−.30	+.10	+.05
			G_L	−.25	−.45	−.05	−.70	−.20	−.40	−1.00	+.20	−.10	−.65	−.25	−.35	+.25	+.05	−.40	−.15	−.25
			G_U	−.30	.00	+.10	−.20	−.30	−.20	−.15	−.15	−.40	−.60	−.05	−.30	−.10	−.10	−.40	−.20	+.10
			H	−.30	−.25	+.10	−.60	−.15	−.15	−.40	+.10	−.15	−.40	.00	−.25	−.05	−.05	−.40	−.10	−.20
62-----	166.7	25.4	A_S	−.55	−.40	−.35	−.30	−.10	.00	−.50	+.05	−.30	−.20	−.10	−.25	−.10	+.40	.00	+.10	+.25
			A_P	+.15	−.05	+.05	+.20	−.10	.00	−.30	+.05	−.10	−.50	.00	+.15	.00	−.35	−.50	−.10	−.20
			B	−.50	−.55	−.20	−.40	−.15	+.05	−.40	−.10	−.25	−.30	−.15	−.30	−.30	−.15	−.30	−.05	.00
			C_L	−.50	−.35	+.05	−.25	−.20	+.35	−.30	−.30	−.15	−.40	−.20	−.35	.00	−.30	−.55	−.25	−.20
			C_U	−.60	.00	+.50	+.25	−.05	+.50	.00	+.10	+.20	−.25	+.15	−.10	−.40	−.35	−.20	.00	−.30
			D	−.60	−.85	−.35	−.50	−.50	−.55	−.55	−.50	−.40	−.55	.00	−.55	−.20	−.30	−.60	−.50	−.50
			E_S	−.40	−.60	−.45	−.50	−.40	−.40	−.40	−.20	−.20	−.65	−.20	−.10	−.10	−.25	−.35	−.50	−.25
			E_P	+.25	+.20	+.25	−.50	−.20	+.15	+.15	+.40	+.10	−.85	+.05	.00	.00	.00	−.20	+.30	.00
			F	−.45	−.35	−.15	−.60	−.10	−.30	−.30	+.10	.00	−.75	−.10	−.40	−.15	−.20	−.20	−.15	−.55
			G_L	−.45	−.65	−.30	−1.00	−.35	−.60	−.30	−.20	−.40	−.70	−.30	−.40	.00	−.30	−.65	−.30	−.40
			G_U	−.60	−1.00	−.80	.00	−.10	−.50	−.30	−.20	−.40	−.70	−.30	−.30	.00	−.40	−.20	−.10	−.50
			H	−.70	−.70	−.55	−1.10	−.40	−.80	−.60	−.50	−.50	−.65	−.40	−.50	−.40	−.60	−1.00	−.55	−.60
65-----	175.2	21.7	A_S	−.65	−.20	+.40	−1.45	+.10	−.70	.00	−.15	−.30	−.50	+.10	.00	−.90	−.50	−.40	−.30	+.15
			A_P	−.40	−.70	−.00	+1.55	−.20	+.35	−.70	+.40	−.70	−1.20	+.50	.00	+.90	+.70	+.30	+.50	+.05
			B	−.35	−.10	+.25	0	+.30	+.50	+.10	+.05	−.10	−.10	+.30	+.25	−.20	+.20	+.10	+.20	+.20
			C_L	−.65	−.15	+.30	0	+.10	+.85	+.15	−.30	.00	−.40	+.10	+.05	−.30	−.10	.00	+.20	+.45
			C_U	+.05	.00	+.20	+.20	+.05	.00	−.35	−.10	−.10	−.35	−.10	−.10	+.45	+.05	−.40	−.10	.00
			D	.00	+.05	+.20	−.35	.00	.00	+.20	.00	.00	−.70	+.20	−.10	.00	.00	−.40	−.15	.00
			E_S	.00	+.20	+.50	−.30	.00	+.50	+.65	+.50	+.30	−1.00	+.45	+.15	+.20	+.20	+.05	+.30	+.25
			E_P	+.45	+.15	+.30	−.40	.00	.00	+.85	+.65	+.65	−1.20	+.45	+.35	+.40	+.30	.00	+.50	+.40
			F	−.20	−.05	+.40	−.35	.00	.00	+.10	+.35	+.20	−.80	+.45	−.10	+.15	+.20	−.10	+.15	−.10
			G_L	−.35	−.35	−.10	−.75	−.20	−.35	+.20	−.15	−.25	−.80	.00	−.05	.00	−.10	−.50	−.30	−.05
			G_U	−.45	−.15	−.15	−.65	−.60	−.20	−.25	−.35	−1.10	−.90	−.45	−.50	.00	−.70	−.50	−.30	−.40
			H	−.15	−.20	+.10	−.60	+.15	−.20	.00	.00	.00	−.80	+.20	+.15	.00	−.25	−.40	−.15	.00
68-----	183.4	16.9	A	.00	+.15	+.50	0	+.65	+.75	+.60	+.40	+.35	.00	+.70	+.40	+.15	+.55	+.10	+.40	+.60
			B	+.20	+.25	+.75	+.10	+.65	+.90	+.70	+.50	+.75	+.20	+.80	+.70	+.25	+.45	+.45	+.50	+.85
			C	+.20	+.30	+.50	+.10	+.60	+1.30	+.95	+.25	+.40	−.15	+.70	+.50	+.20	+.20	−.10	+.10	+.40
			D	+.30	+.30	+.55	−.10	+.45	+.50	+.70	+.30	+.50	−.30	+.70	+.50	+.15	+.15	−.05	+.15	+.45
			E	+.20	+.35	+.70	−.10	+.40	+.50	+.75	+.70	+.50	−.60	+.75	+.45	+.40	+.30	+.10	+.40	+.40
			F	+.20	+.35	+.65	−.10	+.40	+.40	+.85	+.60	+.40	−.30	+.75	+.40	+.35	+.30	−.05	+.35	+.40
			G	+.15	+.05	+.30	−.35	+.45	+.10	+.50	+.25	+.20	−.15	+.60	+.45	+.30	+.20	−.10	+.10	+.40
			H	+.30	+.25	+.40	−.35	+.50	+.25	+.80	+.30	+.70	−.10	+.65	+.50	+.15	+.10	−.05	+.15	+.45
69½---	187.4	13.9	A	+.25	+.35	+.80	+.20	+.70	+1.00	+.90	+.55	+.70	+.20	+.90	+.80	+.25	+.70	+.40	+.55	+1.15
			B	+.25	+.45	+.75	+.20	+.70	+1.00	+1.00	+.60	+.85	+.25	+.90	+.80	+.20	+.60	+.50	+.55	+1.05
			C	+.50	+.35	+.55	+.10	+.60	+1.25	+1.00	+.60	+.65	+.15	+.85	+.70	+.25	+.30	+.20	+.45	+.80
			D	+.50	+.40	+.80	+.15	+.55	+.70	+.75	+.80	+.70	+.20	+1.00	+.50	+.25	+.30	+.20	+.50	+.90
			E	+.45	+.60	+.90	+.30	+.80	+.95	+.70	+1.05	+.85	+.10	+1.05	+.70	+.50	+.50	+.30	+.55	+.80
			F	+.40	+.65	+1.00	+.20	+.80	+.75	+.90	+.85	+.75	+.10	+1.00	+.70	+.45	+.40	+.20	+.60	+.85
			G	+.50	+.40	+.60	.00	+.60	+.30	+1.00	+.60	+.70	+.10	+.75	+.70	+.25	+.30	+.20	+.45	+.80
			H	+.50	+.45	+.80	−.20	+.70	+.65	+1.30	+.80	+1.00	−.10	+.95	+.70	+.25	+.25	+.20	+.50	+.90
71-----	191.2	10.0	A	+.60	+.65	+1.20	+.30	+.90	+1.25	+1.35	+1.00	+1.25	+.25	+1.15	+1.00	+.45	+.75	+.75	+.85	+1.30
			B	+.60	+.55	+.70	+.25	+.70	+1.05	+1.00	+.75	+.90	+.30	+1.00	+.90	+.40	+.65	+.55	+.60	+1.30
			C	+.60	+.60	+.65	.00	+.70	+1.30	+1.05	+1.05	+.95	+.35	+1.00	+1.00	+.50	+.50	+.35	+.85	+1.20
			D	+.50	+.75	+1.00	+.25	+.75	+.95	+1.05	+1.05	+.95	+.45	+1.10	+.80	+.50	+.45	+.35	+.75	+1.20
			E	+.70	+.65	+1.15	+.45	+1.00	+1.15	+1.00	+1.40	+.90	+.45	+1.35	+1.05	+.70	+.65	+.50	+.90	+1.25
			F	+.60	+.65	+1.15	+.50	+.85	+.95	+.90	+1.00	+1.00	+.30	+1.10	+.90	+.50	+.60	+.40	+.70	+1.30
			G	+.65	+.75	+1.20	+.45	+.90	+1.00	+1.10	+1.05	+1.00	+.30	+1.10	+1.10	+.50	+.50	+.35	+.85	+1.20
			H	+.50	+.60	+1.20	+.10	+.75	+.90	+1.35	+1.05	+1.20	+.20	+1.00	+.80	+.50	+.45	+.40	+.75	+1.20
72-----	193.5	6.8	A	+.80	+.75	+1.10	+.30	+1.00	+1.30	+1.30	+1.25	+1.40	+.25	+1.20	+1.00	+.60	+.85	+.70	+.95	+1.20
			B	+1.00	+.75	+.70	+.30	+.80	+1.10	+1.10	+.70	+1.10	+.35	+1.10	+1.00	+.65	+.70	+.60	+.65	+1.20
			C	+.80	+.80	+.70	+.25	+.85	+1.30	+1.00	+1.10	+1.10	+.40	+1.00	+1.10	+.60	+.70	+.60	+.70	+1.20
			D	+.80	+.75	+1.00	+.40	+.85	+1.15	+1.15	+1.20	+1.10	+.65	+1.10	+.95	+.65	+.65	+.50	+.90	+1.20
			E	+.90	+.70	+1.20	+.50	+1.00	+1.20	+1.10	+1.50	+1.10	+.60	+1.35	+1.20	+.70	+.75	+.60	+.95	+1.20
			F	+.90	+.80	+1.20	+.60	+.90	+1.00	+.95	+1.00	+.95	+.40	+1.10	+1.00	+.55	+.70	+.50	+.80	+1.20
			G	+.80	+.85	+1.30	+.65	+.85	+1.15	+1.15	+1.25	+1.10	+.50	+1.20	+1.10	+.65	+.70	+.45	+.70	+1.20
			H	+.70	+.85	+1.30	+.40	+.80	+1.00	+1.35	+1.15	+1.20	+.40	+1.15	+.95	+.65	+.60	+.50	+.90	+1.20
Nose---	--------	------	------	+3.80	+3.25	+4.20	+3.10	+4.35	+4.60	+4.80	+4.80	+5.15	+4.40	+4.80	+4.40	+3.30	+3.45	+4.00	+4.40	+5.20

TABLE VII

PRESSURE DISTRIBUTION ON THE ENVELOPE

TABLE OF RESULTANT VERTICAL AND HORIZONTAL LOADS AT EACH STATION

Number of station	3	4	5	7	10	12	13½	17	20	26	40
Diameter of envelope at station (ft.)	8.0	12.8	16.5	23.5	31.2	34.7	36.5	39.9	41.3	42.0	39.7
Distance of station from nose (ft.)	2.7	4.7	6.5	11.0	18.3	23.5	27.3	37.4	46.3	63.7	104.2
VERTICAL LOAD IN LB. PER FT. OF LENGTH											
Run No. 1	+3.20	0.00	−1.14	−13.40	−12.50	−12.15	−9.13	−9.17	−4.13	−6.30	+2.78
Run No. 2	−1.60	−2.05	−4.78	−3.06	−26.20	+.69	+4.02	+2.00	+2.06	+3.78	+3.18
Run No. 4	−1.01	−1.02	−7.10	−3.78	−3.12	−1.74	+5.47	+.40	+1.24	−6.30	+.40
Run No. 5	−1.04	−.77	−.49	+.71	.00	−6.94	−9.14	+5.19	−4.13	−.84	+5.96
Run No. 9a	−.56	−1.28	−4.18	+.70	+3.12	−2.43	+4.37	+6.00	−4.55	−4.20	+3.17
Run No. 9b	−2.80	−2.56	−5.75	−1.17	−.93	+1.73	+10.60	+3.60	−6.19	−.84	+9.13
Run No. 13	+.96	.00	+.99	+4.94	−1.56	+12.10	+14.60	−7.98	−7.47	−11.35	−3.18
Run No. 17a	+1.28	−.64	−.83	−2.35	+6.86	−7.29	−2.92	+10.76	−1.24	.00	+5.16
Run No. 17b	+.32	−1.28	−2.97	−3.53	+.31	−1.74	+.73	+6.79	−8.26	.00	+9.93
Run No. 21	−3.84	−8.71	−16.17	−4.00	−6.24	−11.45	−3.65	+17.95	−6.61	+5.04	+11.90
Run No. 23	−4.56	−8.32	−13.20	−11.75	−4.72	−7.98	+.73	+4.79	−7.44	+3.78	+8.74
Run No. 25	−1.68	−4.73	−8.25	−8.24	−4.05	−8.67	−7.30	+3.99	−11.15	−2.94	+4.76
Run No. 27a	+.80	−.64	−2.64	+2.12	+2.18	−10.40	+4.38	+11.18	−7.02	−.42	+7.94
Run No. 27b	+1.28	+.64	−3.47	−2.82	+6.24	−3.12	−1.83	+1.19	−6.62	−6.30	+8.34
Run No. 27c	+2.40	+5.12	+5.45	+3.75	+10.30	−3.47	−1.10	−3.18	−6.20	+1.68	+2.80
Run No. 27d	+2.40	+2.31	.00	−2.35	−2.50	−2.43	+3.65	+6.75	−5.37	−3.36	+2.78
Run No. 28	−.32	−2.43	−4.10	−2.59	−.94	−13.30	−8.40	+.80	−9.10	−.84	+3.18
HORIZONTAL LOAD IN LB. PER FT. OF LENGTH											
Run No. 1	−.40	−5.76	−3.30	−6.10	+.62	+5.21	+2.92	+.80	−1.24	+8.40	+3.57
Run No. 2	−.48	−.25	−.83	−1.41	.00	+2.43	−2.19	−1.20	+2.89	+8.40	+.79
Run No. 4	−.64	−1.28	−1.98	−1.18	+1.56	.00	−.73	+1.99	+2.89	+6.30	+3.97
Run No. 5	−1.36	−3.84	−7.10	−11.75	+11.54	+10.41	+15.70	+2.39	.00	+15.10	+5.16
Run No. 9a	−.88	+2.43	+2.81	+1.64	+9.36	+7.30	+3.65	+4.80	+6.20	+16.40	+3.97
Run No. 9b	+1.84	+3.80	+4.12	+4.70	+7.80	+9.37	+12.20	+4.40	+4.13	+2.10	+9.13
Run No. 13	+.56	+2.18	−.16	+.94	+7.80	+5.90	+6.57	.00	+6.61	+5.88	+1.98
Run No. 17a	+1.68	+2.31	+1.98	+1.18	+5.30	+11.10	+6.90	−1.20	.00	+5.46	−5.16
Run No. 17b	−1.04	−4.22	−5.28	−.24	+8.42	+7.64	+6.95	−1.20	+.83	+16.80	+5.16
Run No. 21	−.88	+1.28	+2.97	+5.41	−1.56	+4.86	+6.21	+16.75	+11.56	+6.30	−1.19
Run No. 23	−1.44	+1.28	−.49	+.94	+13.10	+5.90	+3.29	+2.79	+6.20	+11.32	−1.59
Run No. 25	−.48	−1.02	−.82	+.71	+1.86	+3.47	+3.65	+4.79	−1.24	+8.40	+5.96
Run No. 27a	−1.44	−3.20	−3.80	−3.06	+3.78	+5.90	−5.11	.00	−1.65	+6.30	−4.76
Run No. 27b	−1.04	−.90	+2.15	+6.58	+5.30	+7.64	+4.75	+.79	+.83	+.42	−7.94
Run No. 27c	+.16	+.77	−.49	+.23	+18.70	+13.90	+3.65	.00	.00	+5.05	−1.59
Run No. 27d	.00	+.38	+3.96	+10.60	+7.80	+14.90	+4.02	−5.17	−3.31	.00	−8.34
Run No. 28	+.16	−4.73	−5.43	−2.35	+4.60	+13.85	+6.40	+2.00	.00	+1.68	−2.00

\+ Indicates load acting from bottom to top for vertical loads.
\+ Indicates load acting from starboard to port for horizontal loads.

TABLE VII—Continued

PRESSURE DISTRIBUTION ON THE ENVELOPE—Continued

TABLE OF RESULTANT VERTICAL AND HORIZONTAL LOADS AT EACH STATION

Number of station	49	53	57	59	62	65	68	69½	71	72
Diameter of envelope at station (ft.)	35. 7	33. 0	30. 0	28. 3	25. 4	21. 7	16. 9	13. 9	10. 0	6. 8
Distance of station from nose (ft.)	130. 0	141. 2	152. 5	158. 3	166. 7	175. 2	183. 4	187. 4	191. 2	193. 5
VERTICAL LOAD IN LB. PER FT. OF LENGTH										
Run No. 1	+2. 85	+13. 20	+6. 00	+2. 83	−2. 29	−7. 16	−1. 02	−1. 67	−0. 30	−0. 27
Run No. 2	+6. 78	+12. 20	+8. 40	+4. 25	−1. 02	−6. 73	−1. 86	−1. 95	−. 80	+. 20
Run No. 4	+7. 50	+10. 46	+2. 70	−. 56	−2. 54	−3. 25	−1. 35	−1. 67	−. 70	−. 68
Run No. 5	+12. 86	+16. 17	+12. 00	+6. 51	+. 25	+3. 69	+. 85	−2. 09	−1. 80	−1. 16
Run No. 9a	+9. 64	+9. 90	+2. 70	+1. 42	+2. 03	+2. 82	+3. 04	−. 28	−. 90	−. 34
Run No. 9b	+13. 2	+10. 90	+4. 50	+2. 83	+2. 54	−. 43	+2. 70	+1. 11	+. 50	+. 07
Run No. 13	+2. 50	+6. 60	−4. 20	−4. 80	−3. 56	−9. 35	−1. 18	+4. 03	+2. 50	+1. 22
Run No. 17a	+8. 92	+8. 25	+4. 50	+6. 23	−2. 03	−4. 78	−2. 20	−3. 48	−2. 20	−1. 36
Run No. 17b	+10. 71	+5. 94	. 00	+1. 42	−3. 81	−9. 33	+2. 19	+1. 11	+1. 70	+1. 22
Run No. 21	+20. 70	+25. 40	+11. 70	+6. 51	+6. 35	+6. 30	+6. 25	−. 14	−1. 50	−1. 40
Run No. 23	+12. 12	+13. 20	+5. 40	+. 28	−3. 30	−2. 17	−. 17	−1. 39	−1. 30	−. 20
Run No. 25	+12. 10	+9. 24	+3. 30	+2. 26	+1. 27	+2. 39	+1. 35	+1. 95	−. 20	−. 48
Run No. 27a	+8. 92	+12. 87	+7. 50	+4. 25	−3. 05	−4. 77	−2. 03	−2. 36	−1. 20	. 00
Run No. 27b	+10. 71	+12. 56	+5. 40	+4. 24	−. 76	−2. 82	+2. 15	+1. 67	+. 50	+. 136
Run No. 27c	+7. 48	+6. 30	+2. 70	+8. 50	−4. 32	+. 65	+2. 37	+1. 95	−1. 50	+. 48
Run No. 27d	+8. 20	+9. 90	+5. 10	+3. 40	+1. 27	−1. 74	+. 84	−. 28	−. 50	−. 34
Run No. 28	+10. 71	+7. 90	+3. 60	+5. 36	+5. 08	+. 86	+3. 60	+2. 50	+. 20	. 00
HORIZONTAL LOAD IN LB. PER FT. OF LENGTH										
Run No. 1	−1. 79	−7. 60	−9. 60	−6. 51	+. 76	+. 65	+. 17	−. 70	−. 10	+. 48
Run No. 2	+4. 64	. 00	−. 90	−2. 83	+3. 05	+2. 60	+1. 69	−1. 39	−. 37	−. 48
Run No. 4	+11. 80	+5. 61	+. 60	−. 28	+8. 38	+7. 80	+2. 54	−1. 39	−4. 00	−3. 30
Run No. 5	+10. 71	+10. 23	+5. 70	+6. 22	+10. 92	+10. 20	+5. 07	+2. 08	−1. 80	−1. 56
Run No. 9a	−1. 79	+1. 98	−2. 40	−1. 12	−1. 00	+4. 56	+2. 03	−1. 10	−1. 10	−. 14
Run No. 9b	+12. 50	+16. 50	+3. 00	+7. 66	+13. 45	+10. 20	+11. 00	+5. 70	+1. 50	+. 89
Run No. 13	+3. 57	+6. 93	+2. 40	+2. 83	+. 76	+. 87	+1. 01	−2. 08	−. 90	−. 48
Run No. 17a	−2. 86	−5. 61	−9. 00	−10. 75	−. 76	−2. 17	−. 51	−1. 11	−. 80	−1. 02
Run No. 17b	+7. 86	+4. 95	+2. 70	+2. 26	+2. 03	+2. 17	+2. 07	−1. 25	−1. 00	+. 14
Run No. 21	+4. 29	+8. 25	−1. 80	+2. 83	+8. 13	+9. 55	+1. 69	+2. 36	+1. 00	+. 25
Run No. 23	−1. 07	. 00	−1. 50	−1. 41	+5. 59	+. 43	+1. 01	+. 28	−. 40	−. 54
Run No. 25	+3. 93	+1. 65	−. 30	−. 85	+1. 78	+2. 60	+2. 03	−. 42	−. 30	. 00
Run No. 27a	−9. 64	−2. 64	−11. 10	−9. 90	−1. 27	−1. 73	−1. 18	−1. 25	−. 30	+. 07
Run No. 27b	−2. 14	+1. 98	−8. 70	−6. 52	+3. 31	+3. 91	+1. 18	+1. 11	+. 10	+. 07
Run No. 27c	+2. 50	−. 66	−6. 00	. 00	+2. 79	+3. 48	+2. 88	+1. 40	+. 40	+. 61
Run No. 27d	+1. 79	+. 99	−7. 50	−4. 80	+1. 78	+2. 82	+. 84	−. 28	−. 40	−. 34
Run No. 28	+2. 50	−7. 60	−1. 20	−1. 42	+7. 10	+5. 64	+2. 54	+. 97	. 00	. 00

+ Indicates load acting from bottom to top for vertical loads.
+ Indicates load acting from starboard to port for horizontal loads.

TABLE VIII

MOMENTS OF FORCES ON TAIL SURFACES ABOUT THE C. B.

Run No.	Moment of horizontal forces (lb. ft.)	Moment of vertical forces (lb. ft.)	Run No.	Moment of horizontal forces (lb. ft.)	Moment of vertical forces (lb. ft.)
1	−5, 275	15, 380	21	8, 000	14, 120
2	−22, 589	−165	23	3, 608	17, 900
4	−37, 200	−3, 735	25	−2, 670	4, 240
5	−12, 370	−2, 365	27a	34, 577	8, 450
9a	12, 640	6, 020	27b	35, 100	2, 270
9b	2, 940	5, 058	27c	6, 810	4, 700
13	1, 669	−10, 642	27d	−17, 848	−11, 760
17a	−7, 620	−5, 624	28	−9, 095	27, 440
17b	8, 700	−21, 890			

−Indicates counterclockwise moment. Horizontal forces viewed from top; vertical forces viewed from port.

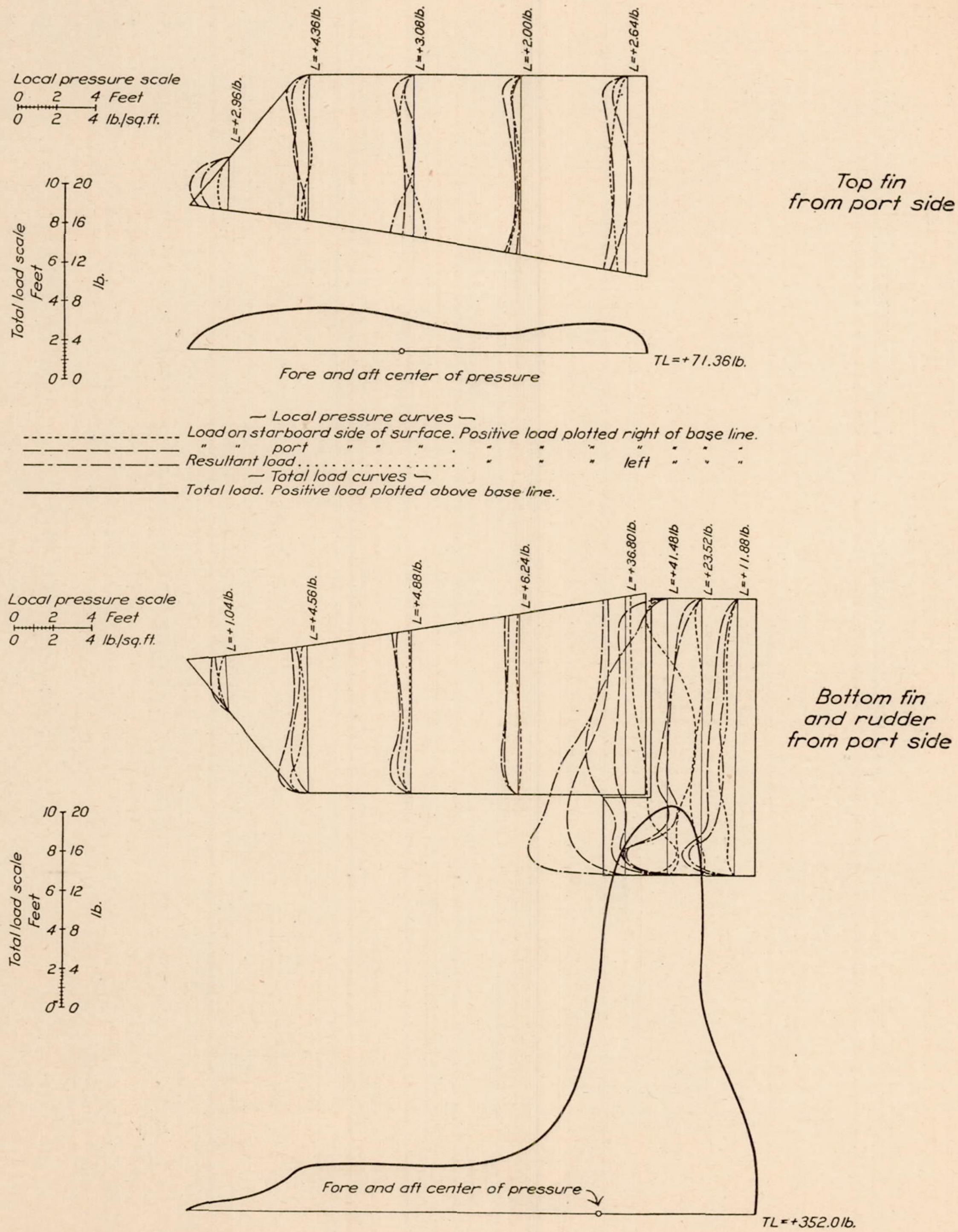


FIG. 9.—Tail surface load curves. Run No. 27b, reversal. Rudder angle 24° left to 18° right. 1,250 R. P. M. Positive loads are those acting from starboard to port

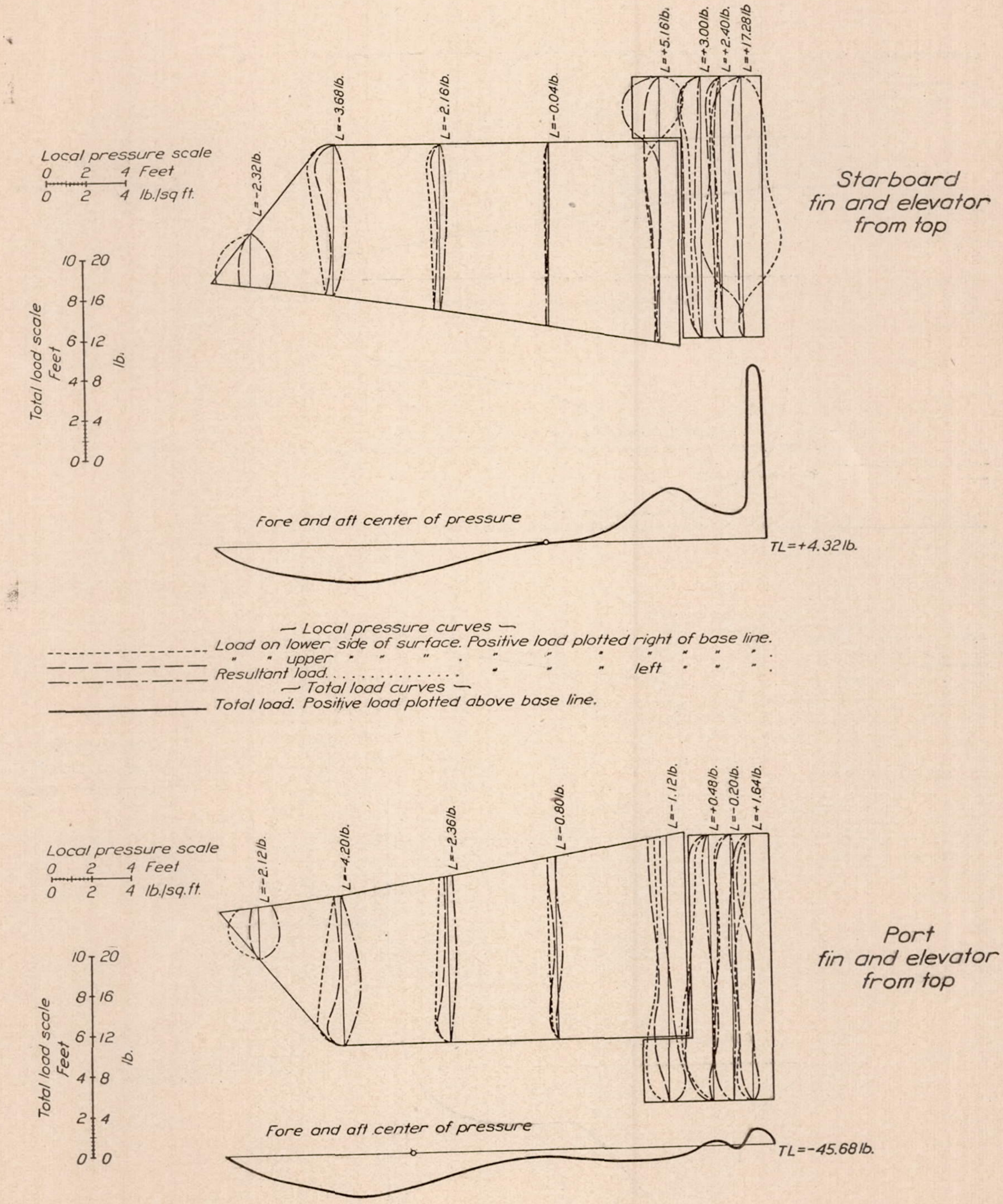


FIG. 10.—Tail surface load curves. Run No. 27b, reversal. Rudder angle 24° left to 18° right. 1,250 R. P. M. Positive loads are those acting from lower side to upper

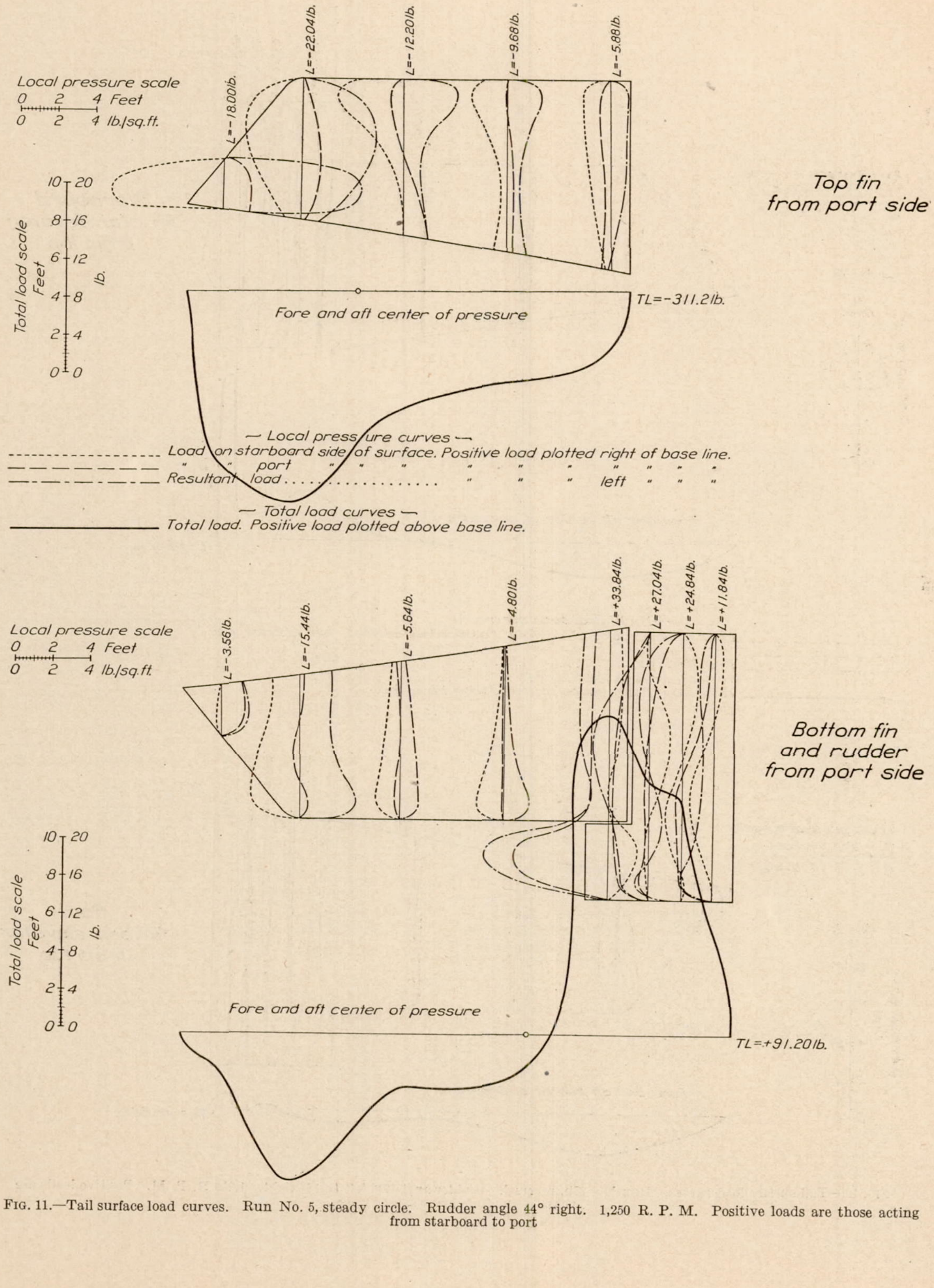


FIG. 11.—Tail surface load curves. Run No. 5, steady circle. Rudder angle 44° right. 1,250 R. P. M. Positive loads are those acting from starboard to port

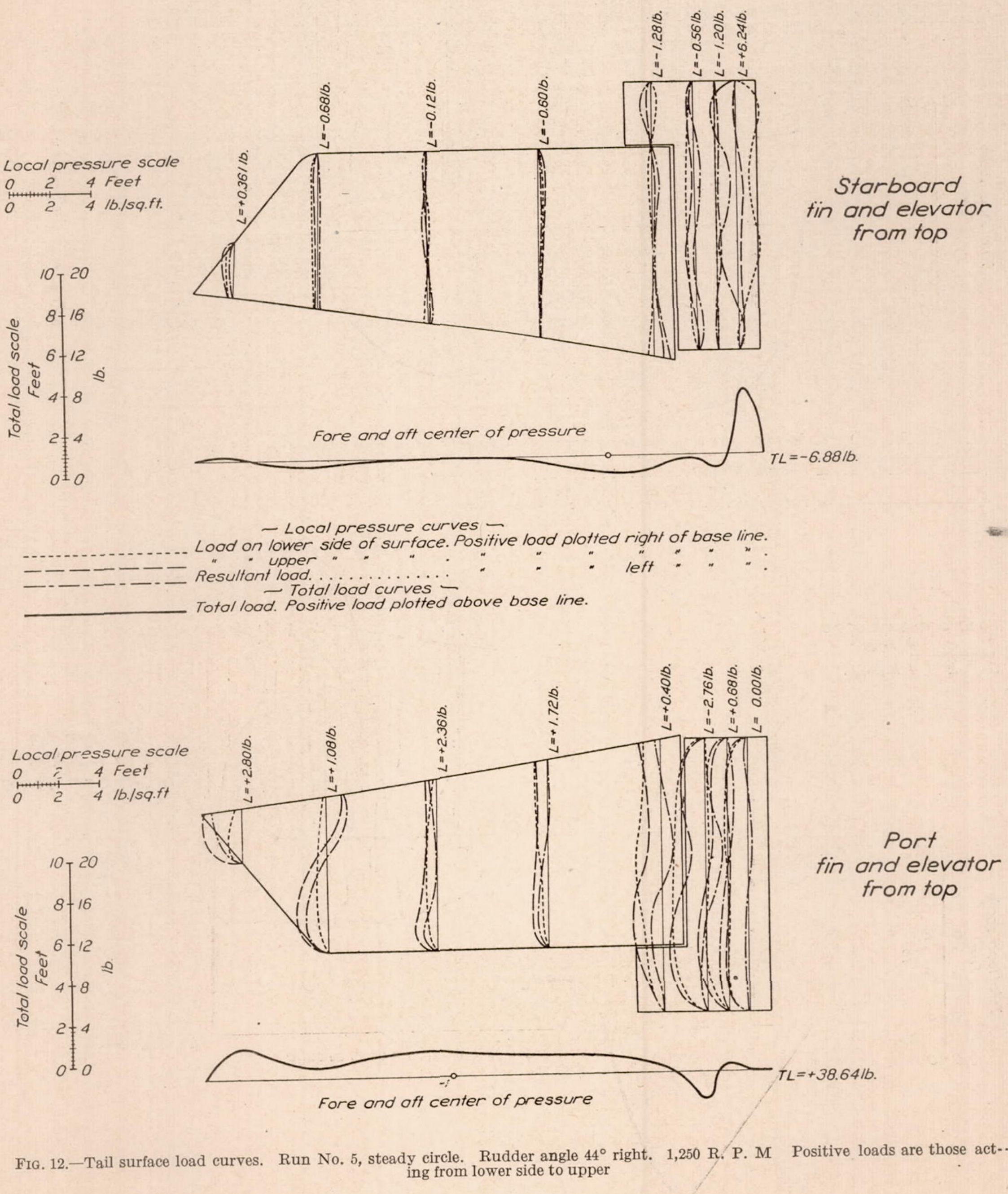


FIG. 12.—Tail surface load curves. Run No. 5, steady circle. Rudder angle 44° right. 1,250 R. P. M Positive loads are those acting from lower side to upper

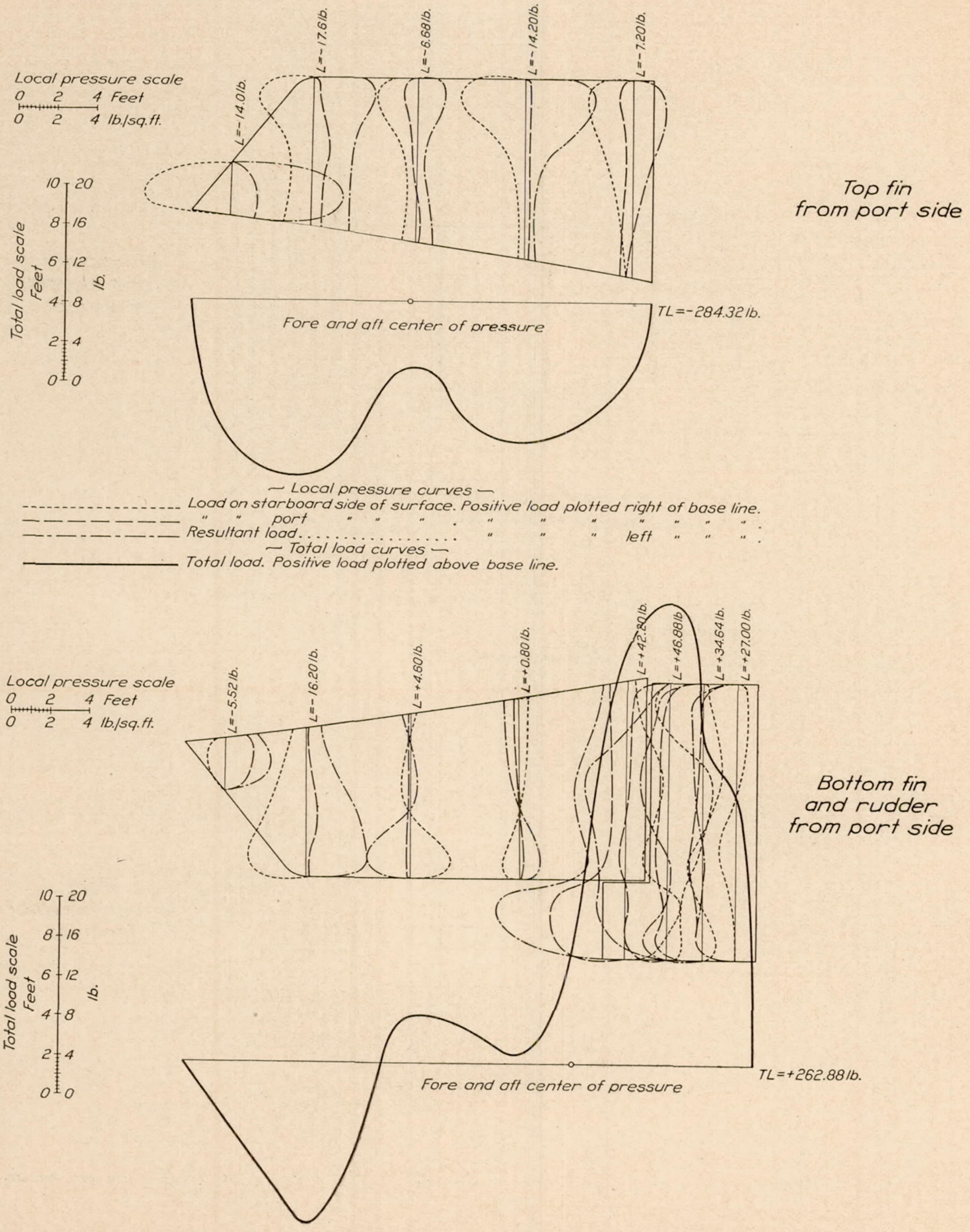


FIG. 13.—Tail surface load curves. Run No. 9b, start circle. Rudder angle 44° right. 1,250 R. P. M. Positive loads are those acting from starboard to port

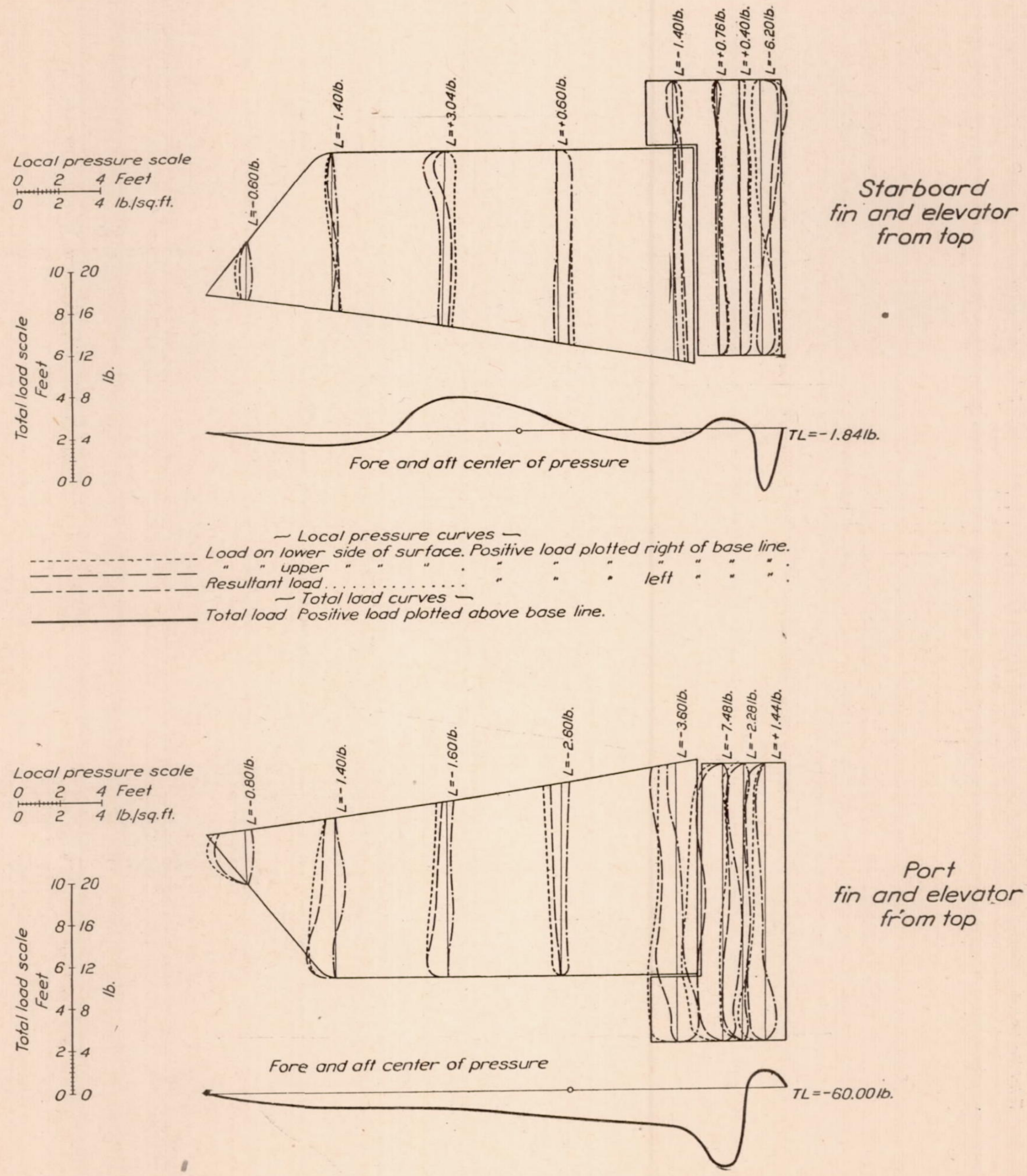
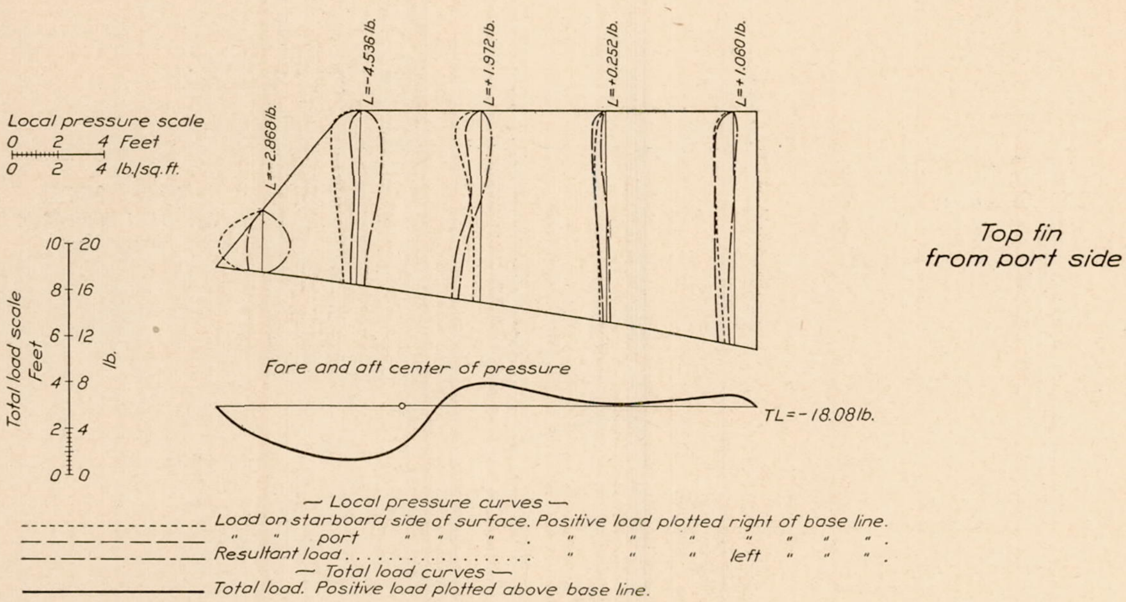


FIG. 14.—Tail surface load curves. Run No. 9b, start circle. Rudder angle 44° right. 1,250 R. P. M. Positive loads are those acting from lower side to upper



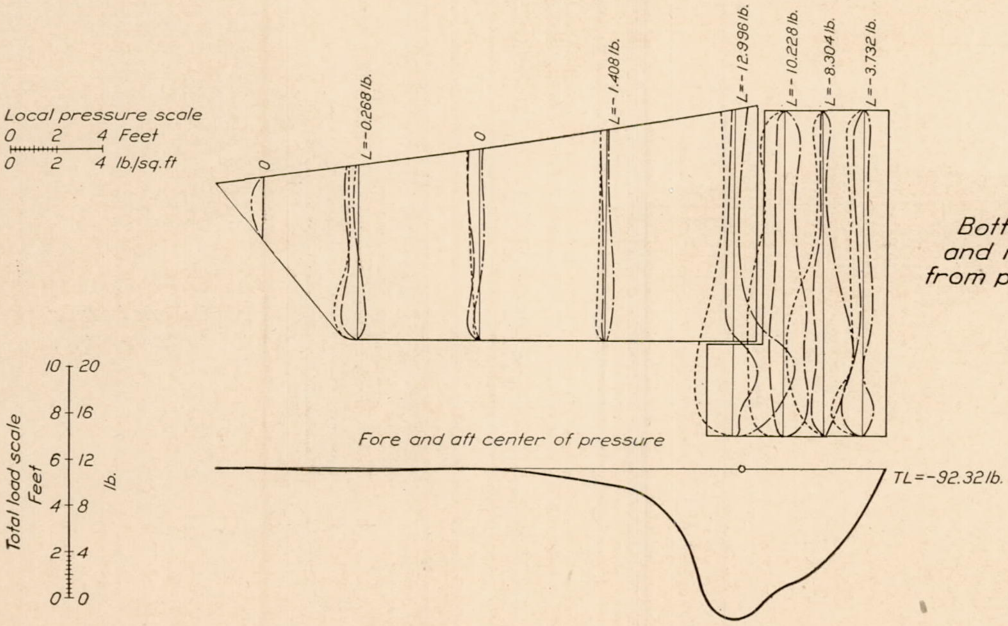


FIG. 15.—Tail surface load curves. Run No. 28, bump. 1,250 R. P. M. Positive loads are those acting from starboard to port

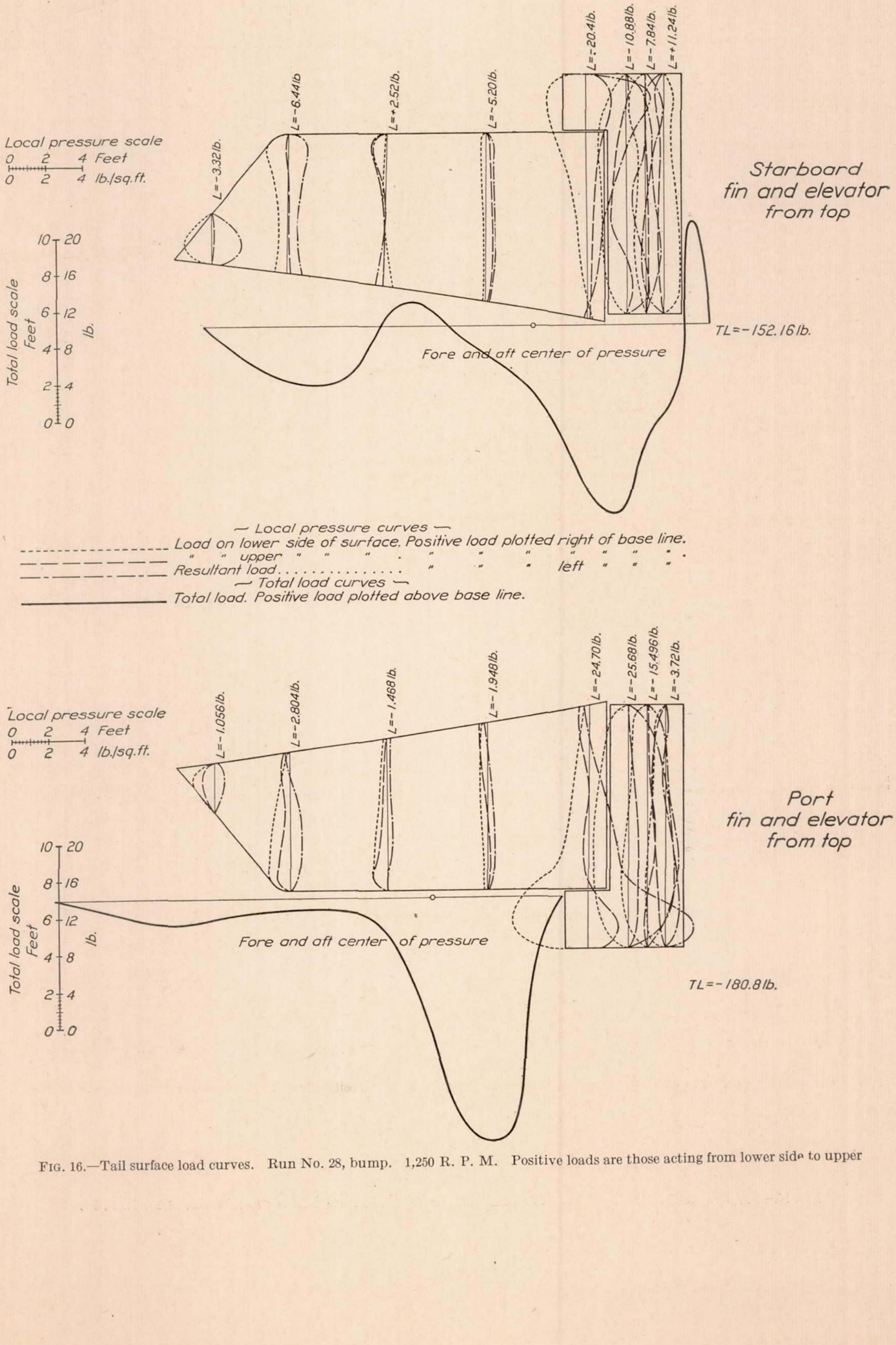


FIG. 16.—Tail surface load curves. Run No. 28, bump. 1,250 R. P. M. Positive loads are those acting from lower side to upper

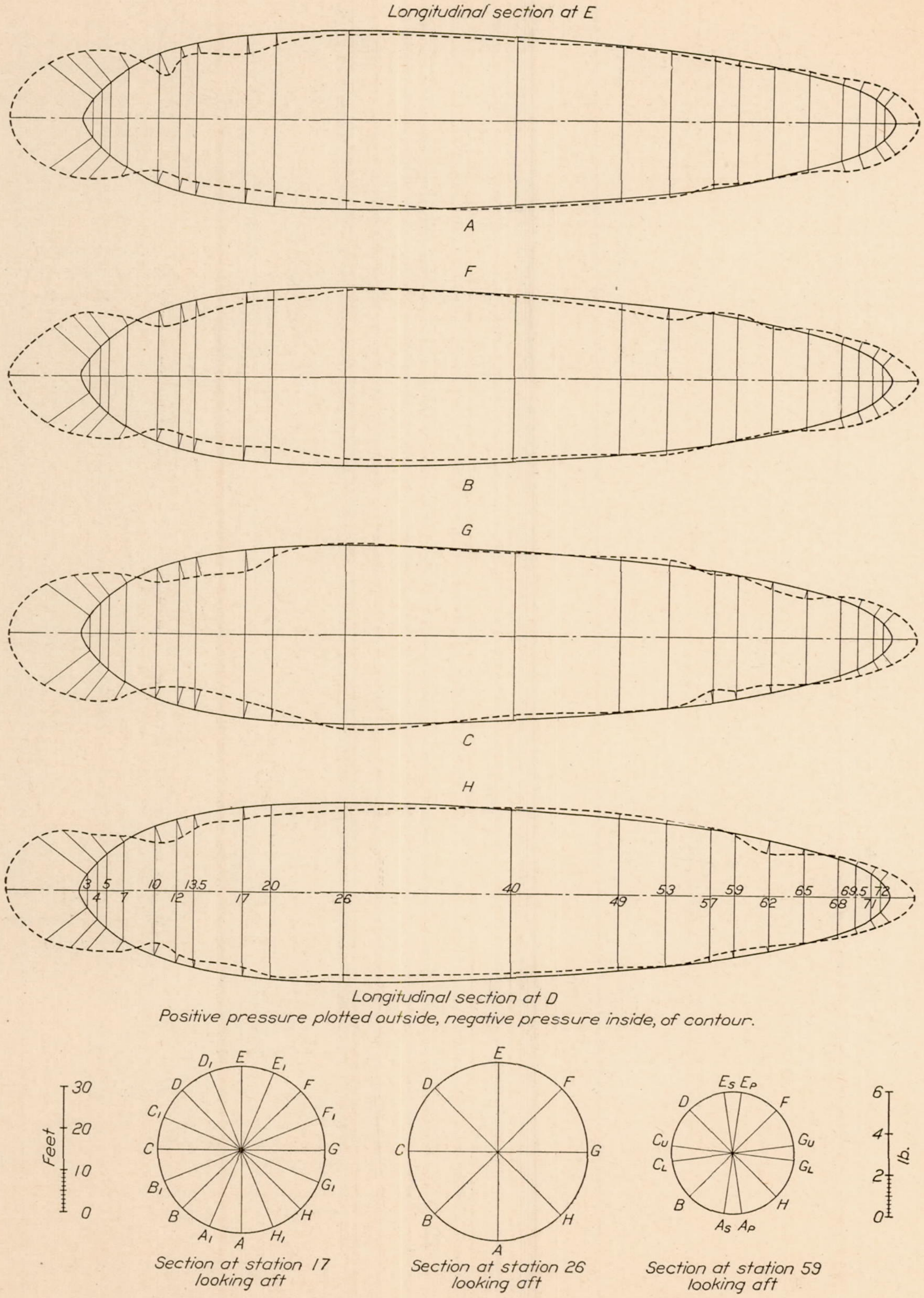


FIG. 17.—Pressure distribution on envelope. Run 27b, reversal. Rudder angle 24° left to 18° right. 1,250 R. P. M.

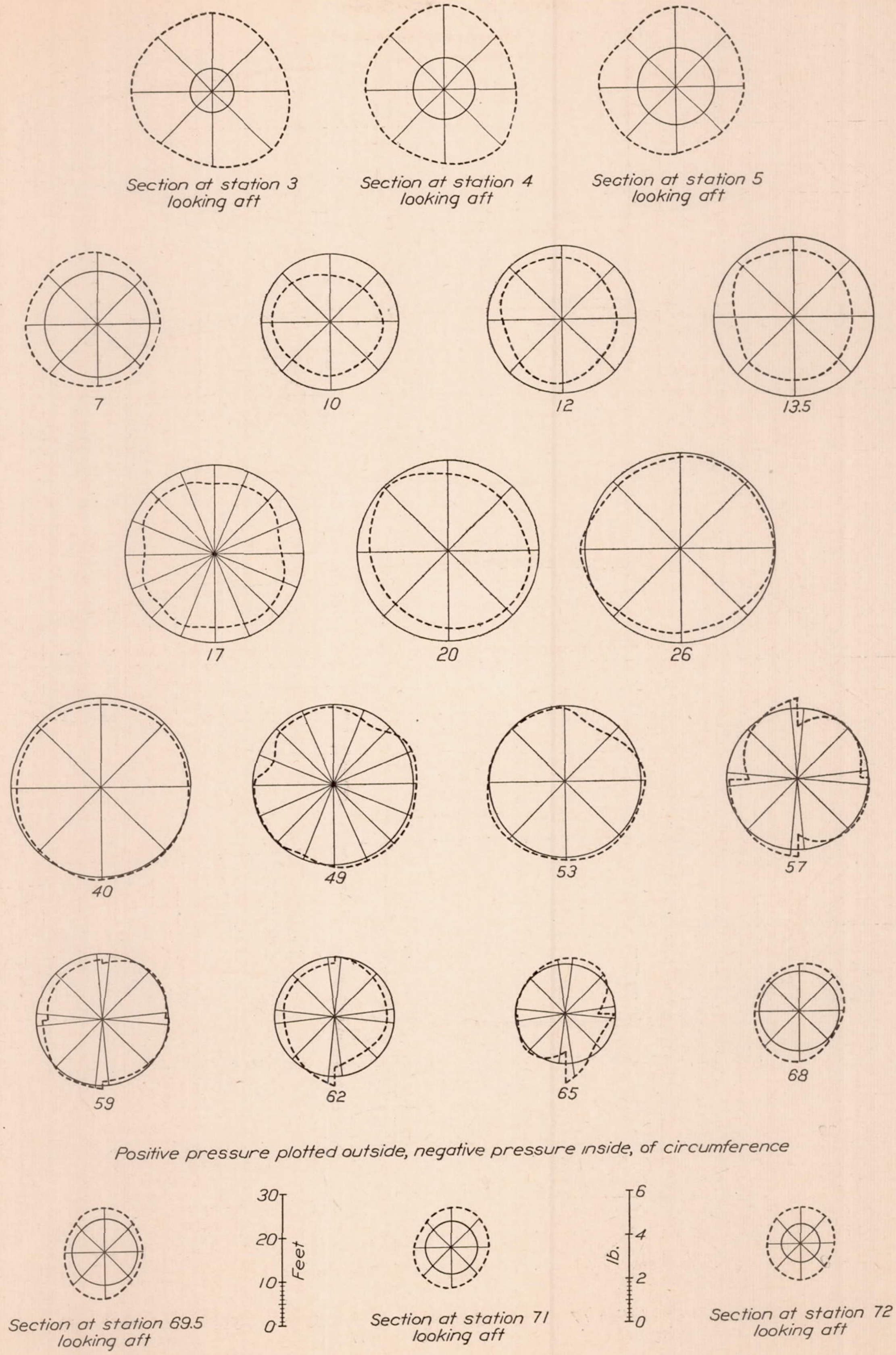


FIG. 18.—Circumferential pressure distribution on envelope. Run 27b, reversal. 1,250 R. P. M.

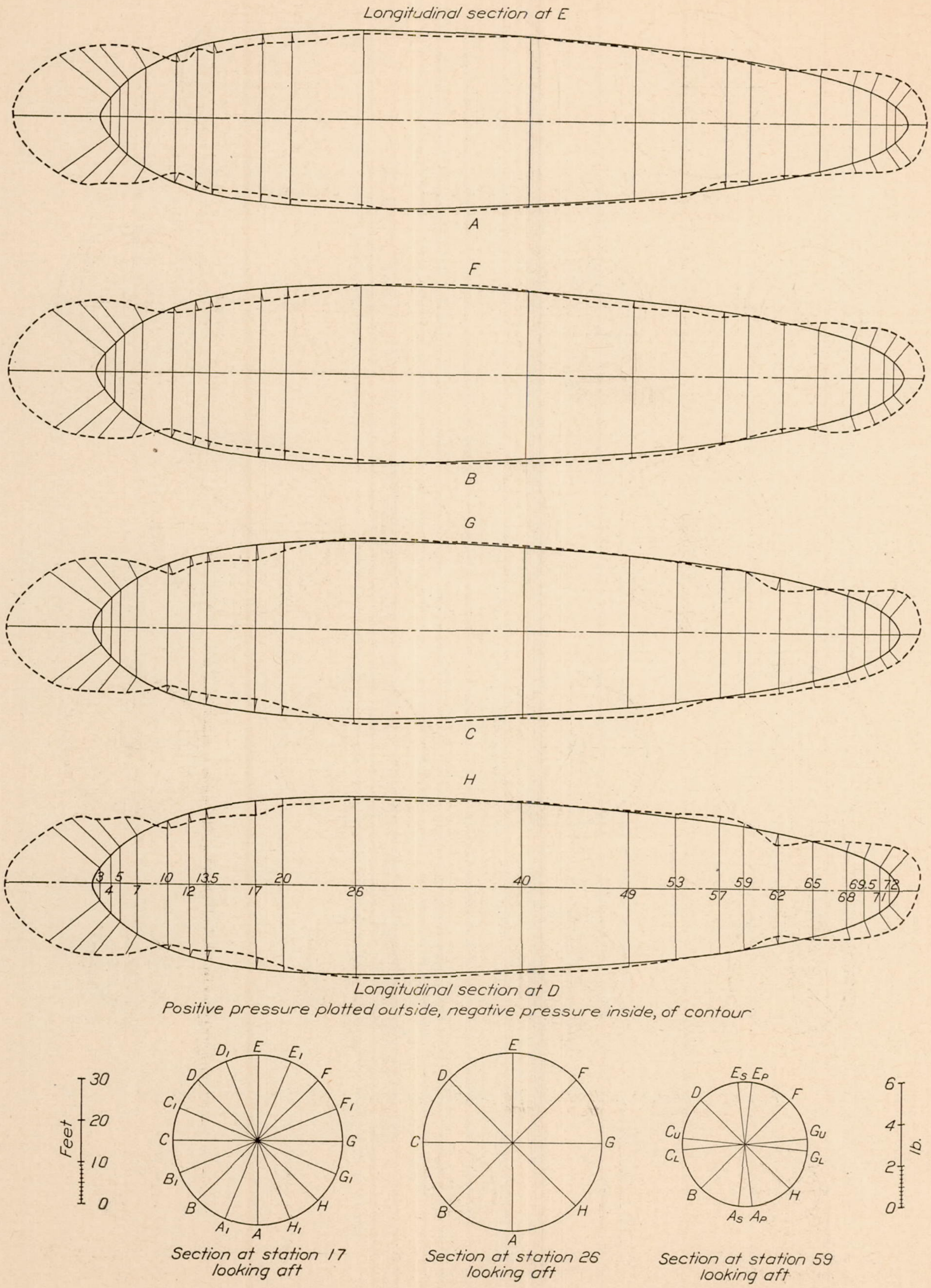


FIG. 19.—Pressure distribution on envelope. Run 4, steady circle. Rudder angle 8° right. 1,250 R. P. M.

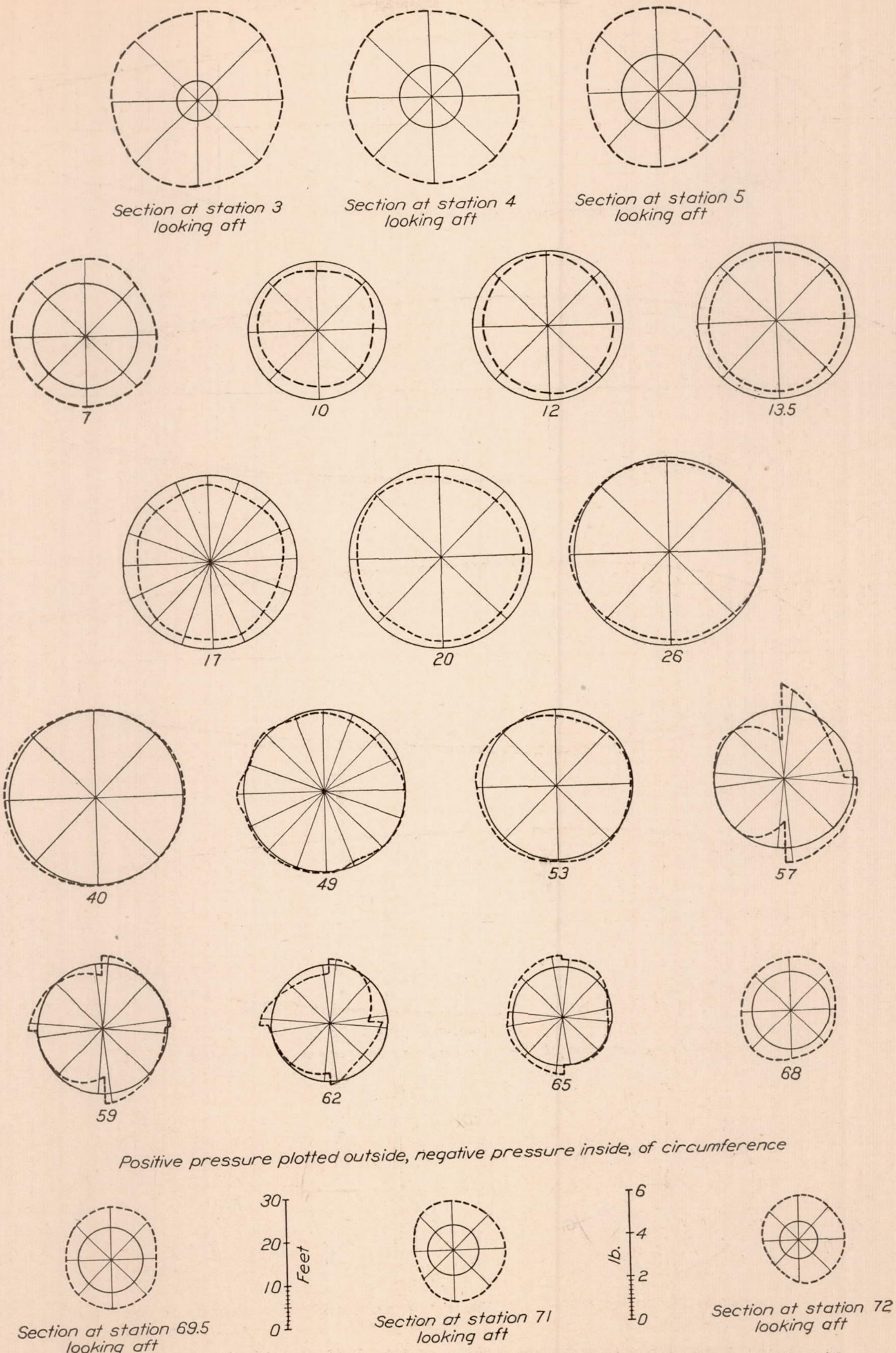


FIG. 20.—Circumferential pressure distribution on envelope. Run 4, steady circle. Rudder angle 8° right. 1,250 R. P. M.

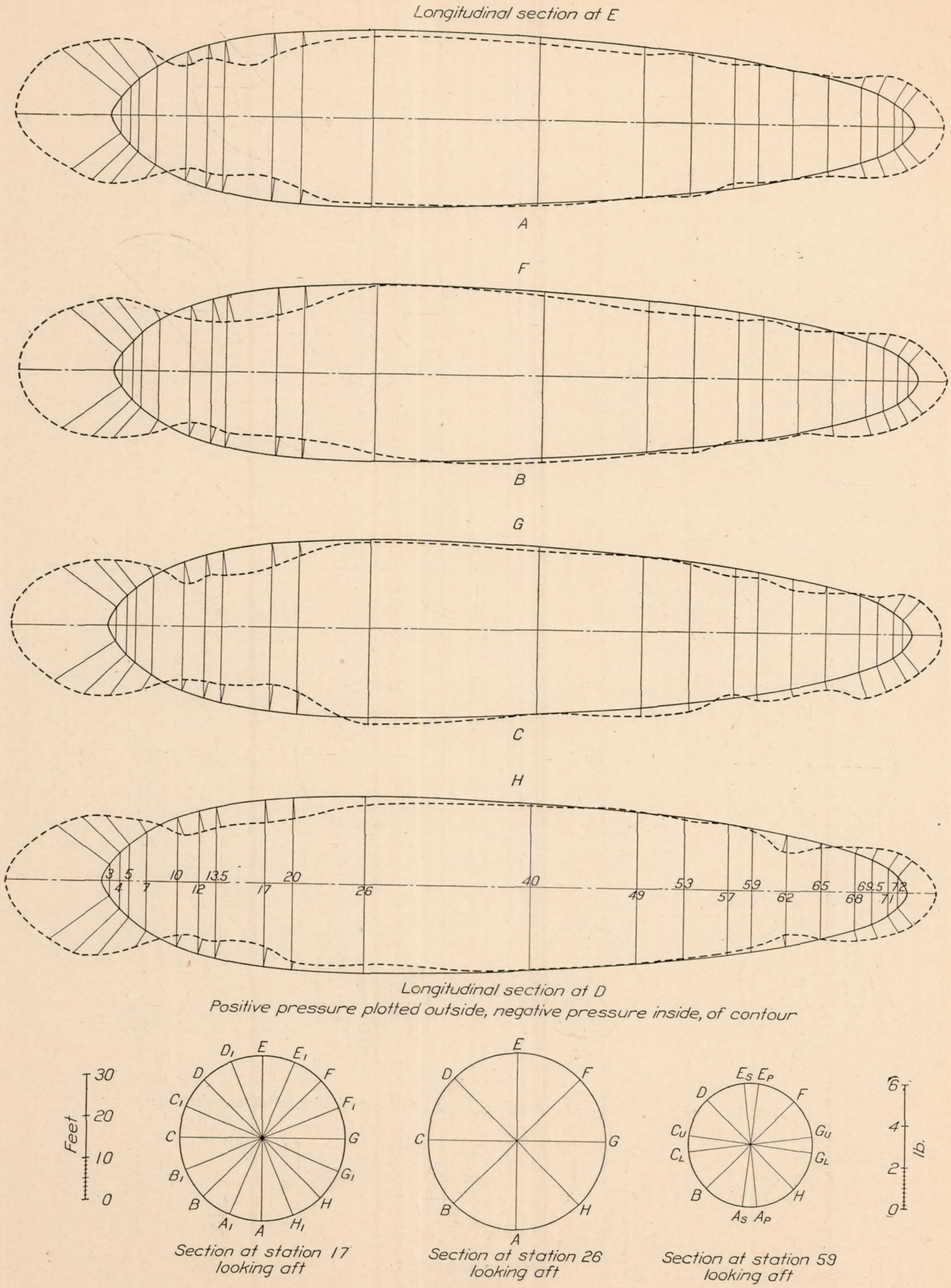


FIG. 21.—Pressure distribution on envelope. Run 9b, start circle. Rudder angle 44° right. 1,250 R. P. M.

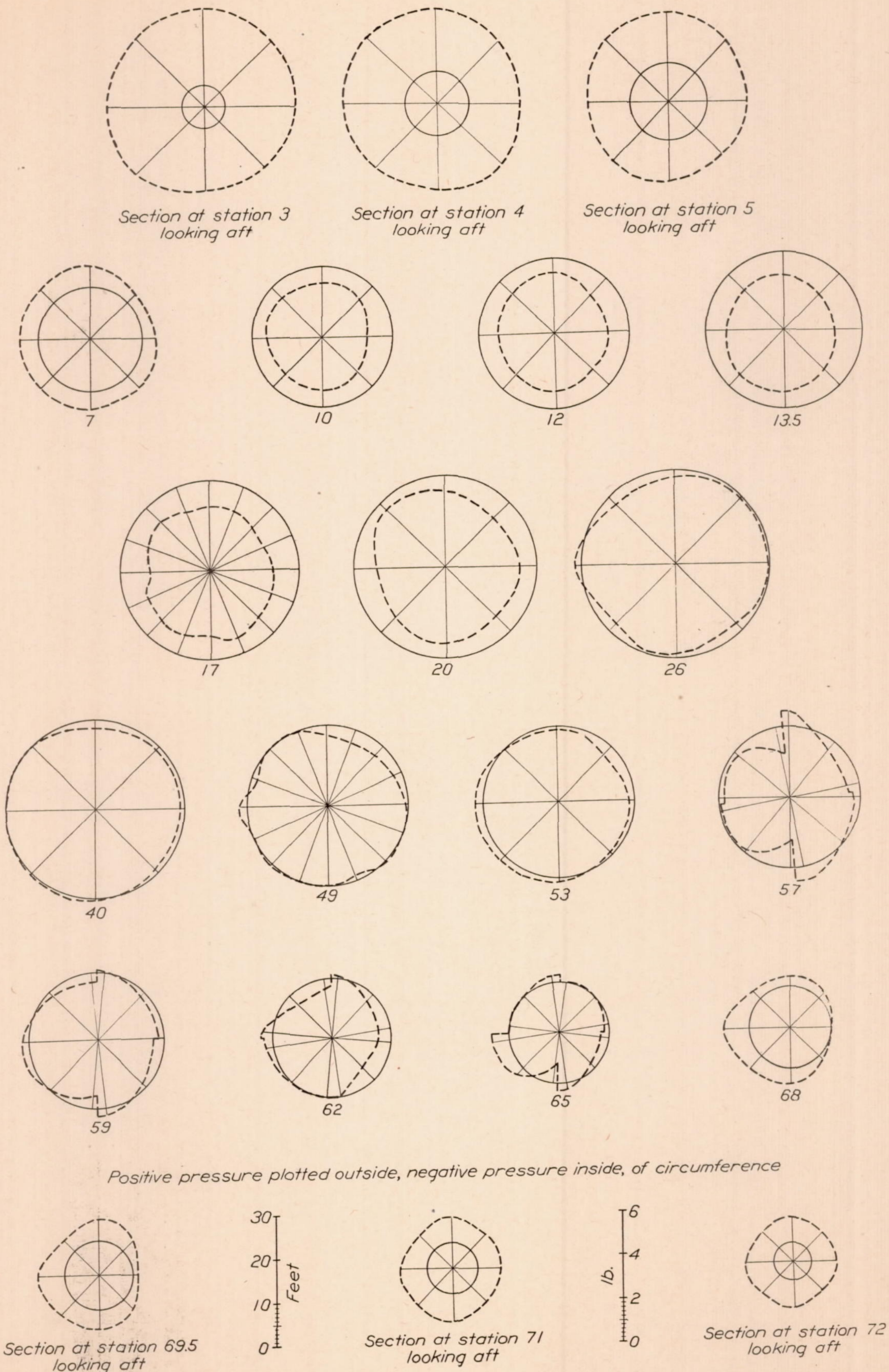


FIG. 22.—Circumferential pressure distribution on envelope. Run 9b, start circle. Rudder angle 44° right. 1,250 R. P. M.

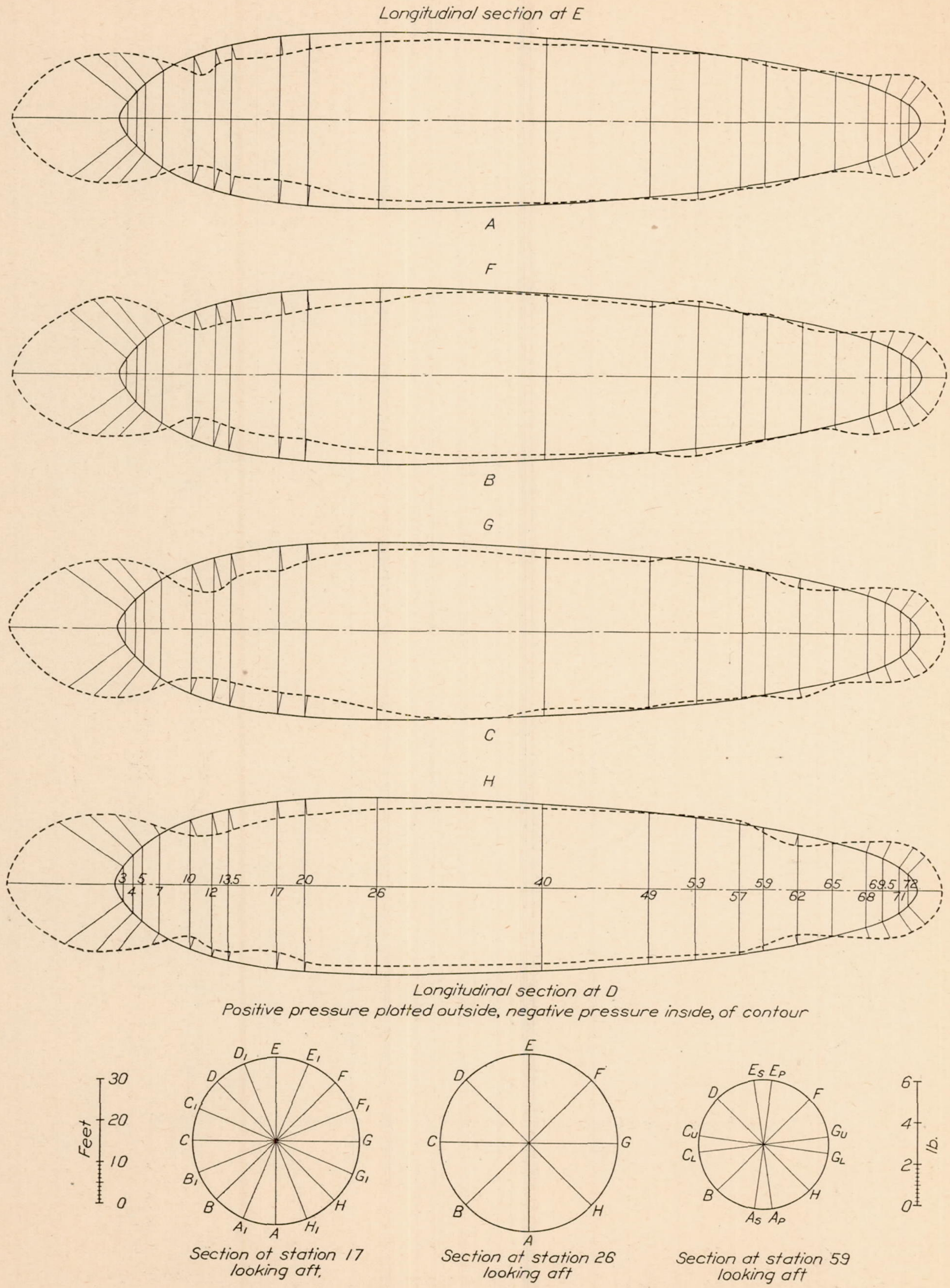


FIG. 23.—Pressure distribution on envelope. Run 28, bump. 1,250 R. P. M.

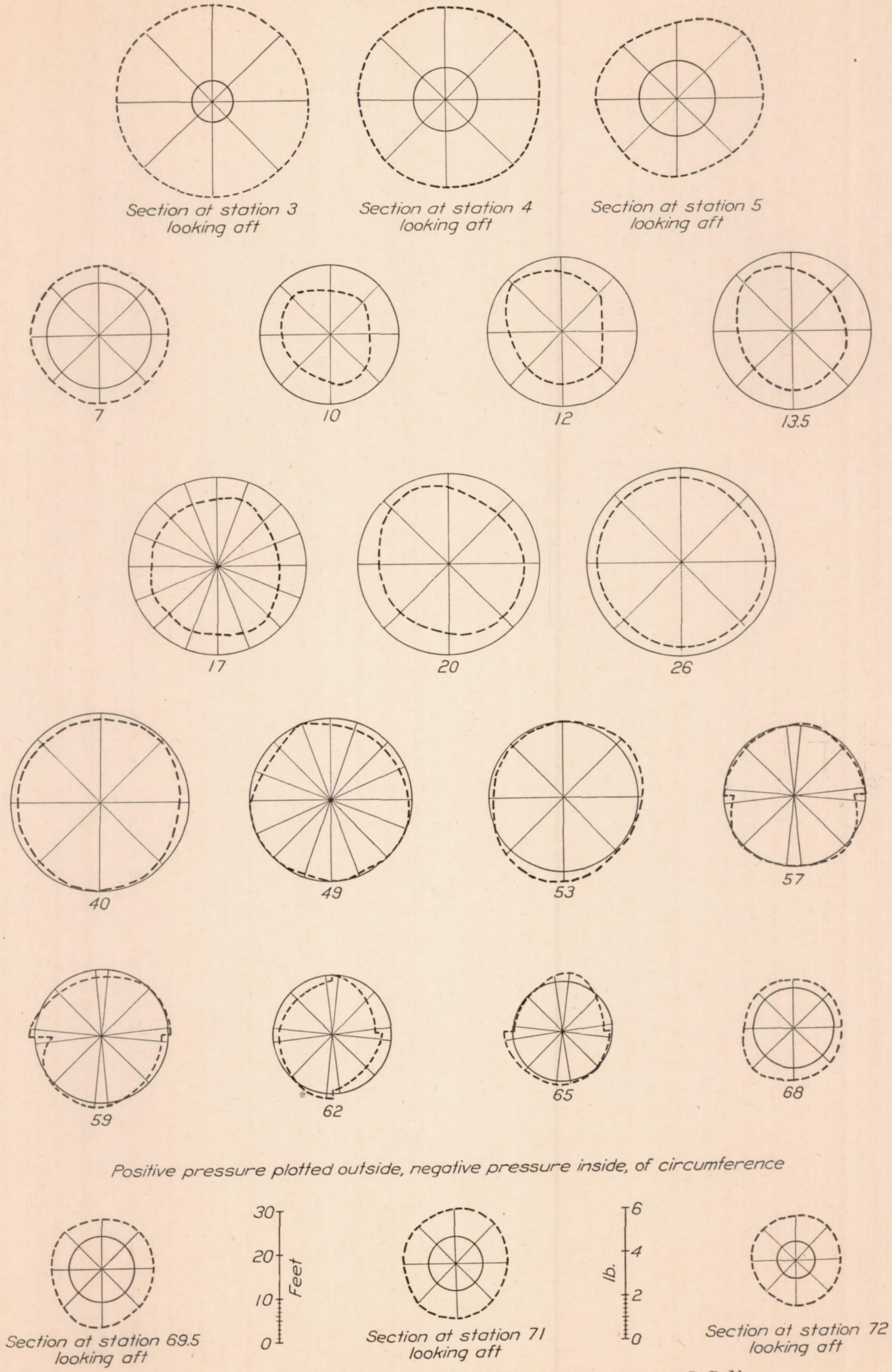


FIG. 24.—Circumferential pressure distribution on envelope. Run 28, bump. 1,250 R. P. M.

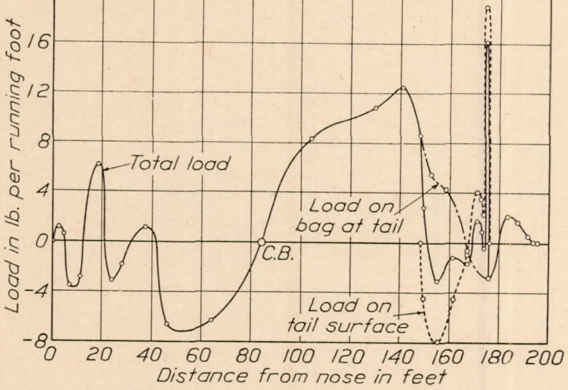


FIG. 25a.—Vertical loads. Run 27b, reversal. Rudder angle 24° left to 18° right. 1,250 R. P. M. Positive loads acting upward. (NOTE.—The moment of the resultant aerodynamic forces on the horizontal tail surfaces about the *C. B.*=2,270 lb./ft. clockwise)

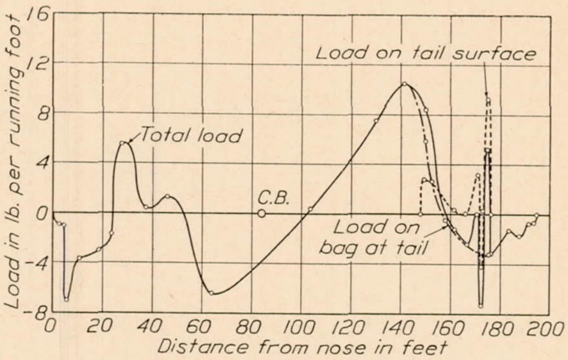


FIG. 26a.—Vertical loads. Run 4, steady circle. Rudder angle 8° right. 1,250 R. P. M. Positive loads acting upward. (NOTE.—The moment of the resultant aerodynamic forces on the horizontal tail surfaces about the *C. B.*=3,735 lb./ft. counterclockwise)

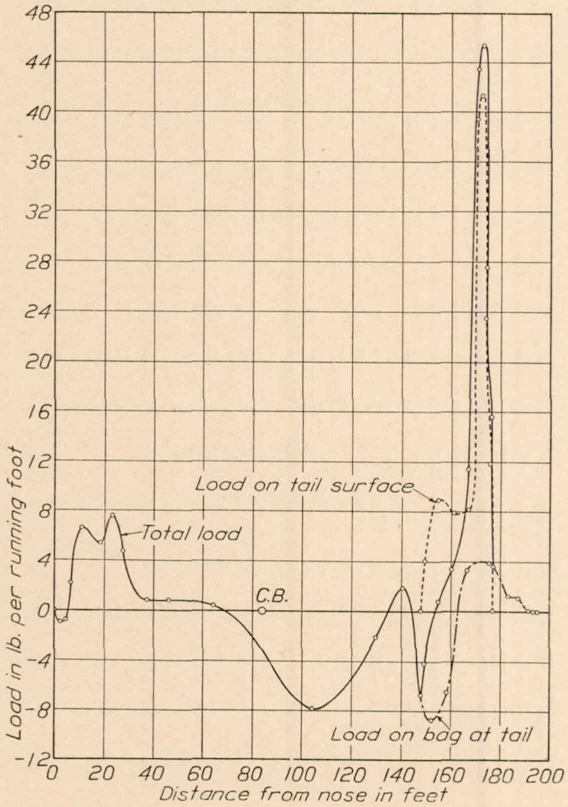


FIG. 25b.—Horizontal loads. Run 27b, reversal. Rudder angle 24° left to 18° right. 1,250 R. P. M. Positive loads acting to port. (NOTE.—The moment of the resultant aerodynamic forces on the vertical tail surfaces about the *C. B.* =35,100 lb./ft. clockwise)

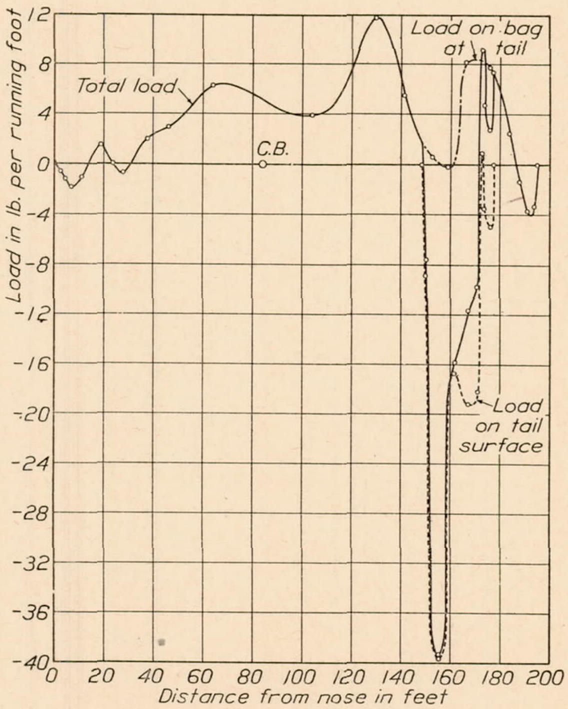


FIG. 26b.—Horizontal loads. Run 4, steady circle. Rudder angle 8° right. 1,250 R. P. M. Positive loads acting to port. (NOTE.—The moment of the resultant aerodynamic forces on the vertical tail surfaces about the *C. B.*=37,200 lb./ft. counterclockwise)

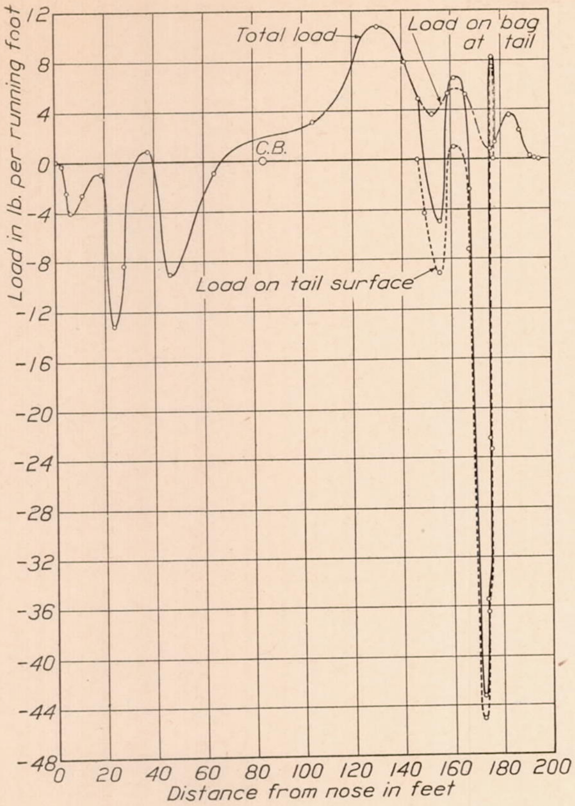


FIG. 27a.—Vertical loads. Run 28, bump. 1,250 R. P. M. Positive load acting upward. (NOTE.—The moment of the resultant aerodynamic forces on the horizontal tail surfaces about the *C. B.*= 27,440 lb./ft. clockwise)

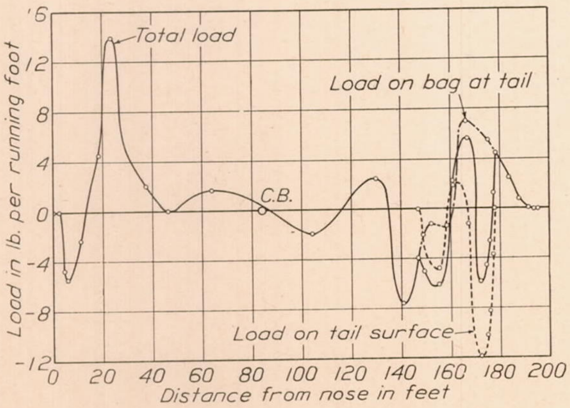


FIG. 27b.—Horizontal loads. Run 28, bump. 1,250 R. P. M. Positive load acting to port. (NOTE.—The moment of the resultant aerodynamic forces on the vertical tail surfaces about the *C. B.*= 9,095 lb./ft. counterclockwise)

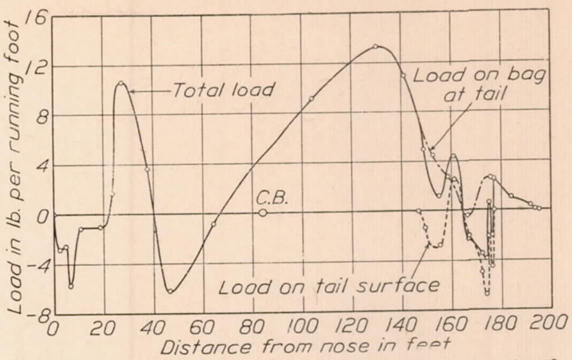


FIG. 28a.—Vertical loads. Run 9b, start circle. Rudder angle 44° right. 1,250 R. P. M. Positive load acting upward. (NOTE.—The moment of the resultant aerodynamic forces on the horizontal tail surfaces about the *C. B.*=5,058 lb./ft. clockwise)

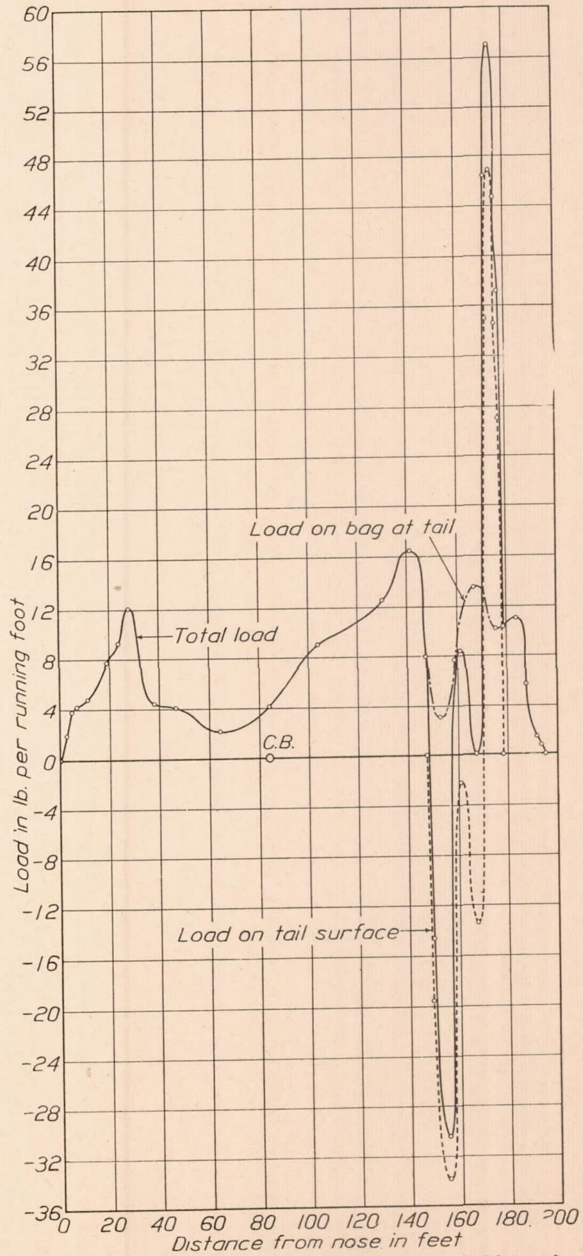
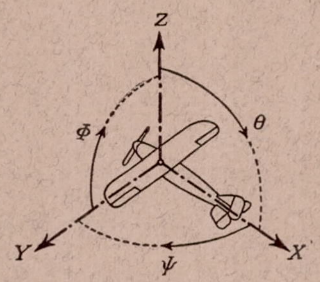


FIG. 28b.—Horizontal loads. Run 9b, start circle. Rudder angle 44° right. 1,250 R. P. M. Positive load acting to port. (NOTE.—The moment of the resultant aerodynamic forces on the vertical tail surfaces about the *C. B.*=2,940 lb./ft. clockwise)



Positive directions of axes and angles (forces and moments) are shown by arrows

Axis		Force (parallel to axis) symbol	Moment about axis			Angle		Velocities	
Designation	Symbol		Designation	Symbol	Positive direction	Designation	Symbol	Linear (component along axis)	Angular
Longitudinal	X	X	rolling	L	$Y \longrightarrow Z$	roll	Φ	u	p
Lateral	Y	Y	pitching	M	$Z \longrightarrow X$	pitch	Θ	v	q
Normal	Z	Z	yawing	N	$X \longrightarrow Y$	yaw	Ψ	w	r

Absolute coefficients of moment.

$$C_l = \frac{L}{qbS} \quad C_m = \frac{M}{qcS} \quad C_n = \frac{N}{qfS}$$

Angle of set of control surface (relative to neutral position), δ. (Indicate surface by proper subscript.)

4. PROPELLER SYMBOLS

Diameter, D.

Pitch (a) Aerodynamic pitch, p_a.

(b) Effective pitch, p_e.

(c) Mean geometric pitch, p_g.

(d) Virtual pitch, p_v.

(e) Standard pitch, p_s.

Pitch ratio, p/D.

Inflow velocity, V'.

Slipstream velocity, V_s.

Thrust, T.

Torque, Q.

Power, P.

(If "coefficients" are introduced all units used must be consistent.)

Efficiency $\eta = T\,V/P$.

Revolutions per sec., n; per min., N.

Effective helix angle $\Phi = \tan^{-1}\left(\frac{V}{2\pi rn}\right)$

5. NUMERICAL RELATIONS

1 HP = 76.04 kg. m/sec. = 550 lb. ft/sec.

1 kg. m/sec. = 0.01315 H. P.

1 mi/hr. = 0.44704 m/sec.

1 m/sec. = 2.23693 mi/hr.

1 lb. = 0.45359 kg.

1 kg. = 2.20462 lb.

1 mi. = 1609.35 m. = 5280 ft.

1 m. = 3.28083 ft.